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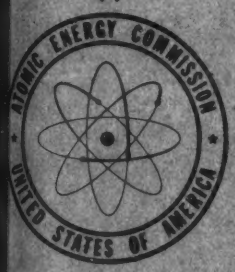

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 August 15, 1956 No. 15

GENERAL

4475

UNITED KINGDOM ATOMIC ENERGY AUTHORITY FIRST ANNUAL REPORT, 1954-1955. London, Her Majesty's Stationery Office, 1955. 35p. $0.50.

BIOLOGY AND MEDICINE

4476 AEC-tr-2461

TYPES OF UNION OF ENZYMES WITH THE PROTEIN COMPLEX OF PLASTIDS. N. M. Sisakyan and A. M. Kobiakova. Translated by Eugenia Artschwager from Biokhimiya 17, 368-75(1952). 14p.

4477

ANTITHYROID PROPERTIES OF 2-AMINO, 5-NITRO-THIAZOLE IN RATS. C. J. Shellabarger and F. C. Schatzlein (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 90, 470-3(1955).

4478

EOSINOPHIL RESPONSE TO TOXOIDS IN ACTIVELY AND PASSIVELY IMMUNIZED MICE. R. S. Speirs and U. Wenck (Brookhaven National Lab., Upton, N. Y. and Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.). Proc. Soc. Exptl. Biol. Med. 90, 571-4(1955) Dec.

4479

A METHOD FOR STUDYING SUCCESSIVE BATCHES OF EGGS LAID BY TREATED OR CONTROL DROSOPHILA. R. C. King (Brookhaven National Lab., Upton, N. Y.). Am. Naturalist 89, 369-70(1955) Nov.-Dec.

Refer also to abstract 4809.

RADIATION EFFECTS

4480 HALC-TR-55-2

Brown Univ., Providence.

EFFECTS ON THE SKIN BY COSMIC RAY HEAVY PARTICLES. Herman D. Chase, Janet D. M. Bliss, William E. Straile, and Janice S. Post. May 1955. 12p. Contract AF33(616)-2085. (AD-68166).

White hairs occurred in clusters in black mice exposed to high-altitude cosmic radiation during high-altitude balloon flights. The white hairs were attributed to exposure to heavy cosmic particles. No other abnormal skin effects were observed. (C.H.)

4481 UCRL-3386

California. Univ., Berkeley. Radiation Lab.

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1956. Apr. 30, 1956. 18p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Data are presented from studies on the bone deposition and excretion of Ce^{144} in adult and fetal rats; the toxic effects of intramuscularly administered Ra^{223} in rats; the radioinduced oxidation of acetic acid; the radioinduced oxidation of simple amines; the mechanism for indirect action of radiation on glycine in aqueous solution; and the performance of a formic acid–oxygen actinometer for cyclotron dosimetry. Routine radiation monitoring activities for the period are summarized. (C.H.)

4482 UR-441

Rochester, N. Y. Univ. Atomic Energy Project.

THE EFFECTS OF IONIZING RADIATIONS FROM EXTERNAL SOURCES ON GAMETOGENESIS AND FERTILITY IN MAMMALS. A REVIEW. George W. Casarett. May 1, 1956. 48p. Contract W-7401-eng-49. $7.80(ph OTS); $3.30(mf OTS).

This paper is a review of some experimental and clinical data, other than purely genetic data, which pertain to the effects of irradiation from external sources on the gonads, gametogenic processes, and fertility of mammals. Dose-effect data are given. The influence of protraction and of fractionation of dose on effect are considered. Some theoretical explanations of contradictory data are attempted. Comparisons are made between laboratory animals and humans, with respect to radiosensitivity of gametogenic processes and recovery capacities. Estimates for human sterilizing doses are given. Data involving radiation-induced infertility and semi-sterility are related to cytologic effects in the germinal epithelium and gametes. The relative radiosensitivities of germinal elements and their embryonic primordia in immature animals are considered. Semen analysis is discussed with respect to usefulness as an indicator of radiobiologic effect. The value of extensive semen analyses for the determination of effective sperm counts and the establishment of a male fertility index is considered. (auth)

4483 UR-442

Rochester, N. Y. Univ. Atomic Energy Project.

DATA PERTAINING TO SHORTENING OF LIFE SPAN BY IONIZING RADIATION. H. A. Blair. Apr. 30, 1956. 42p. Contract W-7401-eng-49. $7.80(ph OTS); $3.30(mf OTS).

Using the median or average life span as a criterion, most of the existing data on shortening of life in mammals as a consequence of exposure to whole-body irradiation from x ray and γ ray sources are reviewed graphically. Related data on the variation of lethal dose, LD_{50}, with age are discussed. With chronic irradiation in daily doses, ranging from low values to as high as 120 r per day, the shortening of life is about proportional to the dose for total accumulated doses below 3 times LD_{50} and amounts to about 7% per LD_{50} or about 10% per 1000 r. The effect with single doses is proportional to dose up to about $^2/_3$ of LD_{50} but is considerably greater per roentgen, amounting to about 23% per LD_{50}. With larger single doses in the lethal range the effect is still greater attaining a value near 50% for survivors of a LD_{50} dose. (auth)

4484 USNRDL-TR-79

Naval Radiological Defense Lab., San Francisco.

INDUCTION OF INTESTINAL CARCINOMA IN THE MOUSE BY WHOLE-BODY FAST NEUTRON IRRADIATION. P. C. Nowell, L. J. Cole, and M. E. Ellis. Mar. 9, 1956. 20p. Project NM 006-015.04.

4485 USNRDL-TR-80

Naval Radiological Defense Lab., San Francisco.

PROBLEMS OF THE DELAYED EFFECTS OF IONIZING RADIATION. R. W. Brauer, J. S. Krebs, C. H. Murden,

and H. W. Carroll. Mar. 2, 1956. 18p. Project NM 006-015.04.

4486 USNRDL-TR-82

Naval Radiological Defense Lab., San Francisco.
INCIDENCE OF NEOPLASMS IN MICE PROTECTED AGAINST LETHAL DOSES OF X-RAY BY SPLEEN HOMOGENATE. L. J. Cole, P. C. Nowell, and M. E. Ellis. Mar. 22, 1956. 21p. Project NM 006-015.04.

Previous studies have shown that the injection of splenic homogenates after otherwise 100% lethal whole-body x radiation exposure (800 r) affords protection against acute mortality in mice. In the present study, a total of 138 survivors from these protection experiments have been maintained and observed until natural death in order to investigate long-term effects. Malignant tumors of the leukemia-lymphoma type occurred in less than 1% of these mice; whereas in a group of non-irradiated mice of the same age the incidence was 22%. The occurrence of other malignant tumors, of ovarian adenomas, and of nephrosclerosis in the irradiated spleen-treated mice was markedly increased over that of non-irradiated controls. Analysis of the incidence of nephrosclerosis with respect to age at death reveals a striking rise in the occurrence of this disease during the period when the largest numbers of mice are dying. The data imply that nephrosclerosis is a major cause of late death in these mice. The apparent specific action of spleen homogenate post-protection in preventing radiation-induced leukemia appears to be associated with its promotion of more rapid regeneration of the damaged hematopoietic and lymphoid tissue. (auth)

4487 USNRDL-TR-85

Naval Radiological Defense Lab., San Francisco.
THE EFFECT OF WHOLE-BODY X-IRRADIATION OF MICE ON IMMUNITY TO TETANUS TOXOID. PART II. THE DELAYED IMMUNE RESPONSE TO INJECTIONS OF TETANUS TOXOID. M. S. Silverman and P. H. Chin. Apr. 6, 1956. 17p. Project NM 006-015.

4488 AEC-tr-2472

THE EARLY CHANGES IN BONE MARROW AND BLOOD OF IRRADIATED ANIMALS, WHICH WERE DETECTED WITH THE LUMINESCENT MICROSCOPE. M. N. Meisel and V. A. Sondak. Translated from Doklady Akad. Nauk S.S.S.R. 105, 1221-4(1955). 5p.

4489

RADIATION TOLERANCE CONTROL. A. Graves. Atomics 6, 278-81(1955) Sept.

Suggestions that the aqueous medium is responsible for the reaction of chemical radiation detectors led to a theory of radiation tolerance control in humans. Control of tissue liquid content is seen as a radiation damage control and as a factor to be considered in x-ray therapy. (D.E.B.)

4490

INACTIVATION WITH FAST CHARGED PARTICLES OF INFECTIVITY AND HEMAGGLUTINATION IN INFLUENZA A VIRUS. John Jagger and Ernest C. Pollard (Yale Univ., New Haven, Conn.). Radiation Research 4, 1-19(1956) Jan.

Two strains of influenza A, MEL and DSP, have been subjected to bombardment in the dry state with charged particles of energies 1 to 8 Mev. Target theory is applied to the resulting inactivations. In all cases, these are found to be single-hit. In the case of MEL the effect of bombardment with deuterons and α-particles of varying rates of energy loss shows the presence of two regions, one of high sensitivity and one of much lower sensitivity, the radii being 246 and 346 A, respectively. This last is slightly smaller than the values found in electron micrographs. The insensitive region is probably to be identified with lipid. For both strains, the hemagglutinin is a flat target, of axial ratio 1:6, and with an equivalent molecular weight of 190,000. This hemagglutinin is quite radiationresistant, showing a requirement of at least three ion pairs per particle for inactivation. (auth)

4491

THE ACTION OF IONIZING RADIATIONS ON BIOLOGICAL MATERIALS: FACTS AND THEORIES. J. A. V. Butler (Chester Beatty Research Inst., London). Radiation Research 4, 20-32(1956) Jan.

Possible mechanisms of radiation effects on biological materials are reviewed. 26 references. (C.H.)

4492

THERMAL NEUTRON EQUIVALENCE OF WHOLE-BODY X-IRRADIATION. L. F. Nims and L. Lewis (Brookhaven National Lab., Upton, N. Y.). Radiation Research 4, 42-8 (1956) Jan.

Growth delay under standardized experimental conditions can serve as a convenient and practical dosimeter that is particularly useful for mixed radiations. The thermal neutron flux equivalent to 1 r of x rays for the biological end point of growth delay is 0.79×10^{10} n/cm^2. (auth)

4493

A COMPARATIVE STUDY OF DOSE-ACTION CURVES FOR VISIBLE EYE-COLOR MUTATIONS INDUCED BY X-RAYS, THERMAL NEUTRONS, AND FAST NEUTRONS IN MORMONIELLA VITRIPENNIS. Marion Kayhart (Univ. of Pennsylvania, Philadelphia). Radiation Research 4, 65-76(1956) Jan.

Virgin female wasps (70,449) were treated with a series of doses of x rays, thermal neutrons, and fast neutrons. They were set unmated, and their haploid sons (354,439) were examined for bright eye-color mutants. Dose-action curves for production of visible eye-color mutations by each of the three radiations were obtained. The shape of the curves is similar; each shows an initial linear portion and then a rise more rapid than that calculated for proportionality. It is suggested that the mutations occurring at the lower doses, forming the linear part of the curve, are due to single hits, and that the proportion of two-hit mutations (small deletions and inversions) increases rapidly at the higher doses, causing the curve to rise steeply. The neutron data adequately fit this one-hit two-hit hypothesis, but in spite of the general resemblance of the three curves the x-ray data do not. With visible eye-color mutations in Mormoniella as a criterion, the relative biological efficiency for fast neutrons at the lower doses is between 17 and 21; at higher doses between 2 and 4. This decreased efficiency at higher doses is to be expected if many of the visible mutations are due to minute rearrangements and deletions. (auth)

4494

THE ADDITIVITY OF γ-RAYS AND FISSION NEUTRONS IN PRODUCING SPLEEN WEIGHT REDUCTION. Donn L. Jordan, John W. Clark, and Howard H. Vogel, Jr. (Argonne National Lab., Lemont, Ill.). Radiation Research 4, 77-85(1956) Jan.

The per cent spleen weight reduction, 5 days post-irradiation, is a function of log dose for both Co^{60} γ-rays and fission neutrons for the dose ranges investigated. The neutrons are 4.42 times as effective per unit energy absorbed in producing splenic weight reduction in mice from the 20% through the 80% range. The value at 50% weight reduction is 4.42 ± 0.45. No departure from additivity could be demonstrated for combined doses of Co^{60} γ-rays and fission neutrons in producing spleen weight reduction. This strengthens the hypothesis that these radiations are additive in producing hematological damage. This investigation, combined with others using splenic regression as a criterion, shows that biological effectiveness per unit energy absorbed increases for radiations dissipating from 0.3 to 30 kev/μ of path. (auth)

4495

COMPARISON OF CYTOLOGIC EFFECTS PRODUCED BY 220 kV_p ROENTGEN RAYS, RADIO-IRIDIUM Ir^{192} GAMMA RAYS AND 30 MEV_p ROENTGEN RAYS IN THE MICROSPORES OF TRADESCANTIA BRACTEATA. K. C. Bora (Univ. of Cambridge, England). Acta Radiol. 44, 129-44(1955) Aug. (In English)

The relative biologic efficiency of filtered 220 kvp roentgen rays from a Maximar therapy machine, gamma rays of mean energy 0.4 Mev from radio-iridium (Ir^{192}), and filtered and pulsed 30 Mev_p roentgen rays from the synchrotron, in producing chromosomal aberrations in the microspores of Tradescantia bracteata have been determined at several dosage levels. At low levels (100 to 500 r), equal doses of 30 Mev_p roentgen rays and 0.4 Mev gamma rays produce equal frequencies of chromosomal aberrations but, at higher dosages (600 to 1,000 r), the same dose of the former radiation produces consistently lower frequencies of all types of aberration. (auth)

4496

EFFECTS OF ADRENALECTOMY ON SPECIFIC ACTIVITY OF DEOXYRIBONUCLEASE IN RAT SPLEEN AFTER TOTAL BODY X-IRRADIATION. Carl D. Douglass, Paul L. Day, and Thomas W. Snyder (Univ. of Arkansas School of Medicine, Little Rock). Proc. Soc. Exptl. Biol. Med. 90, 702-3(1955) Dec.

Adrenalectomy has been found to have no effect on increased specific activity of rat spleen DNase II following total-body x irradiation, but size of spleen and therefore total quantity of enzyme changed in both irradiated and unirradiated animals. (auth)

4497

CALIBRATING A NEUTRON FACILITY FOR BIOLOGICAL RESEARCH. H. J. Curtis, S. R. Person, F. B. Oleson, J. E. Henkel, and N. Delhias (Brookhaven National Lab., Upton, N. Y.) Nucleonics 14, 26-9(1956) Feb.

This convenient facility provides 9.0×10^8 thermal or 2.3×10^8 fast neutrons/cm^2/sec with low gamma-ray contamination. Calibration techniques include a new graphite ionization chamber for gammas and Hurst's multifoil technique for neutrons. (auth)

4498

ENZYMATIC ACTIVITY OF RADIATED AND NORMAL SALIVARY GLAND TISSUES. James A. English (Naval Medical Research Inst., Bethesda, Md. and Johns Hopkins Univ., Baltimore). Am. J. Physiol. 183, 463-74(1955) Dec.

The problem of evaluating early changes which occur in the salivary glands of rats following radiation was investigated from a metabolic viewpoint. The activities of several enzymes which are involved in the metabolism of carbohydrate were studied by means of observing changes in optical density which occur in coenzymes required in the enzymatic reaction. The assays were performed on supernatant fractions of centrifuged homogenates of the submaxillary-sublingual salivary glands, some of the animals having been radiated locally over these glands 1 to 20 days prior to killing. Within 2 to 3 days following 3 to 5000 r of 200 kvp x ray, significant increases were observed in the activities of glucose-6-phosphate and isocitric dehydrogenase when the activities were related to the total protein content of the sample. The total activities for the whole salivary gland for the average animal did not increase however, because of a glandular weight loss following exposure. The total activity for glucose-6-phosphate dehydrogenase remained within the range of non-radiated animals, while isocitric dehydrogenase was significantly decreased between the 4th and 14th days but tended to rise toward the end of the 20-day study period. The possible relation of these findings to changes in salivary flow following radiation is discussed. (auth)

4499

CIRRHOSIS OF THE LIVER IN RATS FOLLOWING TOTAL-BODY X IRRADIATION. Julius White (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, Suppl., 1617-18(1955) Apr.

4500

EFFECTS OF IRRADIATION ON THE METABOLISM OF NUCLEIC ACIDS AND THEIR ACID SOLUBLE DERIVATIVES IN THE RAT. A. Bećarević, K. Kaćanski, D. Mančić, and Ljiljana Hadžić (Inst. of Nuclear Science "Boris Kidrich," Belgrade). Experientia 12, 23-4(1956) Jan. (In French)

In the rat, x irradiation leads to a decrease of the net RNA and DNA content of the spleen, without, however, increasing the low molecular weight nucleic acid derivatives in the acid-soluble fractions of the same tissue. It is suggested that an alteration of the cell membranes could account for the apparent elimination of these nucleic acid degradation products which should normally appear in the acid-soluble fraction. (auth)

4501

RIBONUCLEASE. IV. THE EFFECT OF WHOLE BODY X-IRRADIATION ON THE RIBONUCLEASE SYSTEM OF RAT LIVER. Jay S. Roth (Hahnemann Medical Coll., Philadelphia). Arch Biochem. Biophys. 60, 7-13(1956) Jan.

Rats were subjected to 600 r of whole-body x irradiation, and RNase assays were carried out on liver homogenates and fractions, at intervals after irradiation. A significant decrease was noted in the RNase activity, measured at pH 7.8, of separated mitochondria prepared from the livers of irradiated animals. RNase inhibitor activity in the supernatant fractions obtained from the livers of irradiated rats, was depressed by 12 and 41% in two experiments, 1 day after irradiation, when compared to control values. Recovery to control levels was observed by the second day after exposure. The RNase activity of whole liver homogenate, measured at pH 5.8, showed only small changes from control values, in irradiated animals, while activity at pH 7.8 in whole homogenate or supernatant fraction from irradiated animals did not show significant changes from the control levels. Some implications of these results were discussed. (auth)

4502

A STUDY OF THE PHOSPHORUS COMPOSITION AND P^{32} INCORPORATION IN IRRADIATED LYMPHATIC TISSUE. Helen Harrington and Paul S. Lavik (Western Reserve Univ., Cleveland, Ohio). J. Cellular Comp. Physiol. 46, 503-15 (1955) Dec.

The administration of a toxic dose of P^{32} to adult rats caused a striking decrease in the DNA phosphorus concentration in thymus and spleen and a smaller decrease in the RNA phosphorus concentration in thymus. No other phosphorus fraction of thymus and spleen nor any of the phosphorus fractions of liver were significantly affected by irradiation. Since the decrease in the DNA concentration of irradiated thymus was not accompanied by a change in the DNA content per nucleus, it apparently resulted from the removal of DNA rich cells. The incorporation of P^{32} into DNA and RNA was reduced in the thymus and spleen of irradiated animals. However, the P^{32} uptake by the other phosphorus fractions of thymus and spleen and by the phosphorus fractions of liver was essentially normal. The specific effect of irradiation on the DNA of lymphatic tissues suggests that the results may be due to an inhibition of DNA synthesis and/or new cell formation. Since the life span of lymphatic cells is very short, such an inhibition would promptly lead to cellular depletion and changes in chemical composition in these tissues. (auth)

Refer also to abstract 4794.

RADIATION HAZARDS AND PROTECTION

4503 AERE-SPAR-15

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOIL-PLANT-ANIMAL RELATIONSHIPS OF FISSION PRODUCTS CONFERENCE, JULY 21–23, 1955. PAPER 15. SUMMARY OF LEADING POINTS. A. C. Chamberlain. July 1955. 3p.

Data presented at this conference on fission product metabolism by plants and animals are briefly summarized. (C.H.)

4504 AMRL-229

Army Medical Research Lab., Fort Knox, Ky.

INFLUENCE OF POLYVINYL–PYRROLIDONE COMPOUNDS ON THE POST-IRRADIATION SYNDROME. W. Parr, J. Kereiakes, and A. Krebs. Dec. 12, 1955. 18p. AMRL Project No. 6-59-08-014.

Under strictly controlled conditions low molecular weight Polyvinyl-Pyrrolidone, such as Periston "N", exhibited a tendency to influence beneficially the post-irradiation syndrome in mice. The beneficial effect was slight but, it supports the idea of a possible wash-out of radiation produced toxins by the substances. No protection was afforded by high molecular weight PVPs. (auth)

4505 CEA-508

France. Commissariat à L'Énergie Atomique, Paris.

DANGERS DES RAYONNEMENTS AUPRES DES PILES A URANIUM. (Radiation Hazards near Uranium Reactors). H. Joffre. Jan. 1956. 32p.

Brief discussions on dose units, maximum permissible doses, and relations between units are included. Estimates and data are included on radiation hazards from irradiated U, air contamination, Th irradiated in U piles, and cooling systems. The characteristics of radioelements produced in reactors are tabulated. The radiation hazards in the case of reactor accidents are also briefly surveyed. (B.J.H.)

4506 NM-006-012.04.80

Naval Medical Research Inst., Bethesda, Md.

FURTHER STUDIES WITH CELL-FREE EXTRACTS FROM MOUSE SPLEEN ON X-RAY INDUCED MORTALITY. Friedrich Ellinger. Dec. 23, 1954. 8p.

4507 NM-006-012.05.16

Naval Medical Research Inst., Bethesda, Md.

PHARMACOLOGICAL STUDIES ON IRRADIATED ANIMALS. PART V. THE EFFECTS OF POSTIRRADIATION ADMINISTRATION OF VITAMIN K ON X-RAY INDUCED MORTALITY. Friedrich Ellinger. Sept. 15, 1955. 9p.

4508 TID-3061

Weather Bureau, Washington, D. C.

ANNOTATED BIBLIOGRAPHY ON THE TRANSPORT AND DEPOSITION OF ATOMIC DEBRIS. Robert J. List. Jan. 20, 1956. 31p. $0.15(GPO).

This bibliography presents the results of a survey of the unclassified literature made to obtain references concerning the transport or deposition of fission product radioactivity resulting from the detonation of nuclear devices. Attention is confined to radioactivity transported by atmospheric processes. (auth)

4509

RADIOACTIVE FALLOUT IN SURFACE WATERS. L. R. Setter and A. S. Goldin (Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio). Ind. Eng. Chem. 48, 251-5(1956) Feb.

Radioactive dusts, like other kinds of atmospheric impurities, are removed from the air by falling rain. The 1954 radioactive rainout in Cincinnati, Ohio, was about 0.5 microcuries per square meter or about one tenth of the rainout in 1953. Nearly half the radioactivity was associated with filterable solids, and only 4% of the rain activity was found in pond water. Most of the radioactivity was caught by the leaves, grass, vegetation litter, and soil in the pond drainage area or settled into the mud at the bottom of the pond. (auth)

4510

THE ARTIFICIAL RADIOACTIVITY IN RAIN WATER OBSERVED IN JAPAN FROM MAY TO AUGUST 1954. Y. Miyake. Papers in Meteorol. and Geophys. 5, 173-7(1954) Sept.

Rain water and dust samples collected at 10 stations located throughout Japan were analyzed for radioactivity. The samples were collected from May to Aug. 1954 following H-bomb experiments at Bikini atoll. The maximum activity observed was 0.5×10^{-6} c/l observed in a sample of rainwater collected at Kyoto University on May 16th. (C.H.)

4511

AIRBORNE RADIOACTIVITY. Eizo Tajima and Tadayoshi Doke (St. Paul's Univ., Tokyo). Science 123, 211-14(1956) Feb. 10.

Results are presented from measurements of airborne radioactivity made in Japan from March 16 to May 4, 1955. Radon and thoron daughter products and artificial radioactivity, including α emitters, were detected. Daily variations were correlated with meteorological conditions. Data are tabulated and presented graphically. (C.H.)

Refer also to abstract 4581.

RADIOTHERAPY

4512

A 40 MC CERIUM-PRASEODYMIUM-144 BETA-RAY TELETHERAPY UNIT. J. L. Haybittle and R. V. Faben (Addenbrooke's Hospital, Cambridge, England). Acta Radiol. 44, 49-56(1955) July. (In English)

A beta-ray teletherapy unit is described containing 40 mc of cerium-144-praseodymium-144 and capable of treating areas of up to 7 cm in diameter. The possibility of a larger unit for treating extensive superficial lesions is discussed. (auth)

4513

COLLOIDAL $As_2^{74}S_3$. ITS PRODUCTION AND POSSIBLE USE IN THE TREATMENT OF PAPILLOMATOSIS OF THE URINARY BLADDER. Gunnar Walinder. Acta Radiol. 44, 521-6(1955) Dec.

The author suggests the use of colloidal $As_2^{74}S_3$ in the treatment of superficial papillomatosis of the urinary bladder, since it seems to possess some advantages over the colloids hitherto in use. The method of preparation and the characteristics of the colloid are discussed. Dose rate calculations are presented. (auth)

Refer also to abstract 4805.

TOXICOLOGY STUDIES

4514

THE EFFECT OF LARGE INTRAVENOUS DOSES OF SODIUM BORATE ON THE HUMAN MYOCARDIUM AS REFLECTED IN THE ELECTROCARDIOGRAM. Hadley L. Conn, Jr., Berniece B. Antal, and Lee E. Farr (Brookhaven National Lab., Upton, N. Y.). Circulation 12, 1043-6(1955) Dec.

4515

COMPARISON OF RHEUMATOID (ANKYLOSING) SPONDYLITIS AND CRIPPLING FLUOROSIS. Charles LeRoy Steinberg, Dwight E. Gardner, Frank A. Smith, and Harold

C. Hodge (Univ. of Rochester School of Medicine and Dentistry, New York). Ann. Rheumatic Diseases 14, 378-84(1955) Dec.

TRACER APPLICATIONS

4516 AERE-SPAR-6

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME FACTORS INFLUENCING THE GASTRO-INTESTINAL ABSORPTION OF STRONTIUM IN RATS. PAPER 6. H. G. Jones. July 1955. 4p.

4517 IGO-AM/W-36

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF α AND β ACTIVITY IN FISH. Celia J. Banks and W. G. Duxbury. Apr. 13, 1956. 3p.

4518 UCLA-369

California. Univ., Los Angeles. Atomic Energy Project.

THE DISCRIMINATION OF CALCIUM AND STRONTIUM BY THE KIDNEY. N. S. MacDonald, P. Noyes, and P. C. Lorick. May 31, 1956. 23p. Contract AT-04-1-GEN-12. $3.30(ph OTS); $2.40(mf OTS).

The skeletal retention and the excretion of Sr were directly compared with those of Ca, by injecting solutions containing both radioisotopes, Ca^{45} and Sr^{90}, into rats and rabbits. In normal animals, a greater fraction of the injected dose of Ca^{45} was retained in the skeleton than was observed for Sr^{90}. In complementary fashion, the fraction of the injected Sr^{90} which appeared in the urine was greater than the fraction of the dose of Ca^{45} which was excreted. However, in rats which were actively calcifying tibial fractures, this difference disappeared. The enhanced accumulation of radioactivity in deposits of new bone possessed the same ratio of Sr^{90}:Ca^{45} as the solution injected. Furthermore, when the functions of the kidneys of normal rabbits were impaired by poisoning with mercuric chloride or completely extinguished by nephrectomy, again the usual differences in Ca^{45} and Sr^{90} deposition in bone tissue disappeared. When plasma containing both Ca^{45} and Sr^{90} was shaken with powdered bone, both radioisotopes were extracted in equivalent amounts. It was concluded that the avidity of bone tissue, per se, for Sr ions is not discernibly different from that for Ca ions. The retention by the skeleton of a larger fraction of an injected quantity of Ca than of simultaneously administered Sr was attributed to a renal discrimination causing a greater relative loss of Sr to the urine. (auth)

4519 UCRL-3360

California. Univ., Berkeley. Radiation Lab.

METABOLISM OF THIOCTIC ACID IN ALGAE. Hans Grisebach, R. C. Fuller, and M. Clavin. Apr. 17, 1956. 20p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40 (mf OTS).

4520 UCRL-3396

California. Univ., Berkeley. Radiation Lab.

INTERMEDIATES IN THE PHOTOSYNTHETIC CYCLE. James A. Bassham, S. Alan Barker, M. Calvin, and Ursula C. Quarck. Apr. 24, 1956. 5p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

4521

ANNUAL REPORT OF THE RESEARCH COMMITTEE ON THE APPLICATION OF ARTIFICIAL RADIOACTIVE ISOTOPES IN JAPAN. VOL. I, PART 1. Tokyo, Japan Society for the Promotion Science, Dec. 1951. 151p.

Biological studies are summarized which were carried out in Japan during 1951 in which radioactive isotopes were used as tracers. (C.H.)

4522

A STUDY ON THE PRODUCTIVITY IN COASTAL WATERS BY MEANS OF THE RADIO-CARBON. Y. Miyake, K. Kigoshi, Y. Sugiura, and K. Saruhashi. Papers Meteorol. and Geophys. (Japan) 5, 89-94(1954) Apr.

Radiocarbon was used as a tracer in studies of photosynthesis by phyto-planktons as a means for determining the net productivity of the ocean. As a result of observations on coastal waters, it was ascertained that the diurnal change in the gross production was proportional to that of the solar radiation. A comparison was made of productivity values obtained by the radiocarbon method and by the dissolved oxygen method. (C.H.)

4523

A MODIFIED RESTRAINING CAGE FOR ISOTOPIC STUDIES. William W. Burr, Jr., John A. Marcia, and Herbert C. Tidwell (Univ. of Texas Southwestern Medical School, Dallas). J. Lab., Clin. Med. 47, 326-8(1956) Feb.

A modified rat restraining cage, which has proved useful in isotopic studies using C^{14}, is described. (auth)

Refer also to abstracts 4785 and 4786.

CHEMISTRY

4524 AECU-3253

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT NO. 40 [FOR] PERIOD DECEMBER 1, 1955 THROUGH FEBRUARY 29, 1956. 78p. Contracts AT(30-1)-905 and N5ori-07806. $12.30(ph OTS); $4.50 (mf OTS).

Investigations were continued on the following topics: ultraviolet spectra of indium bromide complexes; titrimetry and coulometry; solvent properties of HCl–β,β'–dichlorodiethyl ether systems; ion exchange of Tl^{3+} and Te^{4+} on Dowex resins; fission yields and decay properties of Ag^{111}, Ag^{112}, Ag^{113}, and Ag^{115}; decay energy of Cs^{139}; thermal decomposition of benzoyl peroxide; cosmic radiation detection and measurement; analysis of bremsstrahlung spectrum from linear accelerator; proton scattering by O^{16}; Coulomb excitation in Re^{187}, Re^{185}, Hf^{179}, Hf^{177}, Lu^{175}, Ho^{165}, and Eu^{153}; nuclear spectroscopy; deuteron reactions of Si^{28}, Al^{27}, and Fe isotopes; inelastic proton scattering by Cd, In, and Sm; positronium formation; design characteristics, operation, and maintenance of synchrotrons; photoproduction of π^0 mesons; K^- interactions; gamma scattering by H_2, Be, Li, and C; and problems in theoretical physics. (For preceding period see AECU-3179.) (C.W.H.)

4525 ISC-699

Ames Lab., Ames, Iowa.

ANNOTATED BIBLIOGRAPHY OF α-FURIL DIOXIME. Charles V. Banks and Joseph P. LaPlante. Feb. 8, 1956. 34p. Contract W-7405-eng-82. $0.30(OTS).

4526

THE POLONIUM HALIDES. PART II. BROMIDES. K. W. Bagnall, R. W. M. D'Eye, and J. H. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3959-63(1955) Nov.

The preparation, properties, and crystal structure of $PoBr_2$, $PoBr_4$, $(NH_4)_2PoBr_6$, and Cs_2PoBr_6 are described. (C.W.H.)

4527

STRUCTURAL ASPECTS OF THE HYDROLYSIS OF TITANIUM TETRAETHOXIDE. D. C. Bradley, R. Gaze,

and W. Wardlaw (Birkbeck Coll., London). J. Chem. Soc., 3977-82(1955) Nov.

The hydrolysis of titanium tetraethoxide in C_2H_5OH has been studied by an ebulliometric technique. The molecular complexities of the titanium oxide ethoxides produced by hydrolysis have been explained in terms of a structural theory based on the assumption that titanium exhibits the coordination number 6 in these compounds. (auth)

4528

INTRODUCTION TO THE STUDY OF CHEMICAL REACTIONS IN FLOW SYSTEMS. S. S. Penner. London, Butterworths Scientific Publications, 1955. 86p.

Principles of chemical kinetics with reference to the limitations of the steady-state approximation for chain reactions and conservation laws for reacting fluids are summarized. The problems of chemical reactions during adiabatic flow through a de Laval nozzle and of heterogeneous combustion are discussed. (C.W.H.)

4529

DIFFUSION AND HEAT EXCHANGE IN CHEMICAL KINETICS. D. A. Frank-Kamenetskii. Translated from the Russian edition by N. Thon. Princeton, Princeton University Press, 1955. 370p.

Fundamentals of diffusional kinetics and combustion theory are presented. Diffusional kinetics is concerned with the role of diffusion in the course of heterogeneous chemical reactions in cases where thermal factors can be disregarded and combustion theory with the role of heat transfer in the course of homogeneous exothermal reactions. (C.W.H.)

4530

ON THE ROLE OF DIFFUSION IN CATALYSIS. Jui H. Wang (Yale Univ., New Haven, Conn.). J. Phys. Chem. 59, 1115-16(1955).

Equations were derived for non-diffusion-limited homogeneous and diffusion-limited heterogeneous catalytic reactions. It is suggested by studies of the isotope effects in the catalytic decomposition of H_2O_2 by MnO_2 that rate laws of heterogeneous and homogeneous reactions can be expressed by a general formulation. (C.W.H.)

ANALYTICAL PROCEDURES

4531 AERE-C/R-533

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF PLUTONIUM IN URINE. A. A. Smales, L. Airey, G. N. Walton, and R. O. R. Brooks. May 1950. Decl. Nov. 9, 1954. 13p.

A method for the determination of Pu in a 24 hr sample of human urine, depending upon the extraction of Pu cupferride in chloroform from a solution of the ashed urine residue at pH 1, is described. The chloroform solution containing the Pu is then evaporated and wet ashed and transferred to a Pu tray for α counting. Experimental details are given showing the recovery of added Pu (> 80%) from mock and real urine and the extent of separation from U and Th. Results obtained in routine operation of the method are also quoted and discussed. (auth)

4532 CCC-1024-TR-186

Callery Chemical Co., Penna.

DETERMINATION OF FREE SODIUM IN SODIUM HYDRIDE. L. B. Eddy, A. E. Messner, and A. E. Weber—P. M. Maginnity, ed. May 23, 1956. 11p. Contract [NOa(s)52-1024-c].

Butyl bromide was found to react quantitatively with Na in liquid NH_3. ($2\ Na + C_4H_9Br + NH_3 \rightarrow NaBr + NaNH_2 + C_4H_{10}$). Butyl bromide dissolved in n-C_6H_{14} was used as the titrant and was added to a solution of Na in liquid NH_3 until its characteristic blue color disappeared. Since C_4H_9Br does not react with NaH under these conditions, this reaction was applied to the determination of free Na in NaH—mineral oil slurries. (auth)

4533 CEA-374

France. Commissariat à L'Énergie Atomique, Paris.

MICROANALYSE QUALITATIVE DES TERRES RARES (CERIQUES ET YTTRIQUES), DU THORIUM ET DE L'URANIUM DANS LES MINERAUX. (Qualitative Analysis of Thorium and Uranium Rare Earths (Ceric and Yttric) in Minerals). H. Agrinier. 1955. 16p.

Procedures for the qualitative microanalysis of ceric and yttric rare earths using oxalic acid, the qualitative determination of Th by calorimetry, and the disintegration of minerals using a potassium nitrate mixture of potassium are outlined. (B.J.H.)

4534 TID-7002

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

RAW MATERIALS DEVELOPMENT LABORATORY HANDBOOK OF ANALYTICAL METHODS. Michael A. DeSesa, comp. and ed. Mar. 30, 1956. 114p. $0.60(OTS).

Analytical procedures used at the Raw Materials Development Laboratory are outlined. Methods are presented for the determination of U, V, and other elements and compounds of interest. (C.H.)

4535 IGRL-T/W8

THE DETERMINATION OF OXYGEN IN WATER IN THE ABSENCE AND PRESENCE OF ACTIVE REDUCING AGENTS. Kurt Wickert and Erna Ipach. Translated by M. W. Buxton from Z. anal. Chem. 139, 181-7(1953). 9p.

The Br_2-difference method is described for the determination of O_2 in the presence of active reducing agents ($Na_2S_2O_4$, Na_2SO_3, and N_2H_4) in water containing natural and added organic impurities. This method may be used for analyses of water containing 5 to 40 μg/l oxygen. (C.W.H.)

4536 RAE-Trans-506

THE DETERMINATION OF SMALL CONCENTRATIONS OF AND ELEMENT IN A POWDER WITHOUT THE USE OF STANDARD SAMPLES. (Dosages des Faibles Quantités D'un Element Dans Une Poudre Sans L'Aide D'Échantillons Standards). J. Gillis and J. Eeckhout. Translated by B. E. C. Jenkins from Spectrochim. Acta. 5, 409-16(1953). 13p. (AD-70442).

A new spectrographic method is described for the determination of an unknown element in a powder sample without the use of synthetic standards. The method allows for the possible effect of the chemical combination of the element on the relative intensities of the measured line pairs. This method has been applied to the determination of Mg in graphite obtained from a sample of modular cast iron. An analysis curve for Mg in graphite, covering the range 0.05 to 1.0% Mg, was drawn from the results obtained. (auth)

4537 TIB/T4495

PHOTOMETRIC MEASUREMENT OF SOME TRINITROTOLUENES. (Misure Fotometriche su Alcuni Trinitrotolueni). R. Carpignano. Translated from Ann. chim. (Rome) 44, 11-19(1954). 11p. (AD-78040).

The reactions of the α-, β-, γ-, and η-TNT in $(CH_3)_2CO$ with concentrated NH_4OH are studied colorimetrically. The $\alpha-\beta$, $\alpha-\gamma$, $\alpha-\beta-\gamma-\eta-$TNT, and $\alpha-$TNT$-$picric acid mixtures are examined, and the intensity of the color obtained by treatment with aqueous NH_3 measured. Transmission-time curves are also plotted for the different mixtures for λ = 650 mμ. (auth)

4538

DETERMINATION OF HYDROGEN IN SOME METALS BY ISOTOPIC EQUILIBRATION. A. N. Zaĭdel, and A. A. Petrov. Zhur. Tekh. Fiz. 25, 2571-3(1955) Dec. (In Russian)

A method of isotopic equilibration followed by spectro-

scopic determination of the isotopic concentration ratio is described. A weighed portion of analyzed metal is placed in a container which is filled with deuterium up to a certain pressure p_D. An isotopic exchange occurs between hydrogen of the metal and deuterium and an isotopic equilibrium is established after a certain time. (The higher the temperature, the shorter the time). With the ratio of isotopic solubilities in the metal already established (at high temperatures it approaches unity), and by determining spectroscopically the concentration ratio of the solubilities in the gas, obtained after equilibration, it is possible to determine the amount of hydrogen in the metal. The experiments were made with Zn, Fe, and alloy of 80% Ni–20% Cr at 1000°C. (R.V.J.)

Refer also to abstract 4573.

DEUTERIUM AND DEUTERIUM COMPOUNDS

4539

ISOTOPIC EFFECT IN VAPOR PRESSURE OF LIQUID DEUTERIOCOMPOUNDS. I. B. Rabinovich, N. N. Sokolov, and P. I. Artyukhin (Gor'kiĭ State Research Inst. of Chemistry) Doklady Akad. Nauk S.S.S.R. 105, 762-5(1955) Dec. 1. (In Russian)

The study of temperature effects on deuteriocompound vapor pressures were made with isopropyl and n-butyl deuterioalcohol (with deuterium in hydroxyl), deuterioaniline ($C_6H_5ND_2$), acetic, butyric, isobutyric, and isovaleric deuterio-acids (with deuterium in carboxyl). A diagram and tables of the isotopic effects on vapor pressures of various compounds are given. (R.V.J.)

FLUORINE AND FLUORINE COMPOUNDS

4540 ANL-5557

Argonne National Lab., Lemont, Ill.

CORROSION STUDIES PERTINENT TO BROMINE TRIFLUORIDE PROCESSES. J. G. Schnizlein, R. K. Steunenberg, and R. C. Vogel. Apr. 1956. 27p. Contract W-31-109-eng-38. $0.35(OTS).

The corrosion rates of certain metals and alloys have been determined in several solutions typical of bromine trifluoride processes. Nickel, Monel and K. Monel showed excellent corrosion resistance in the following solutions at 125°C: BrF_3, 10 mol.% Br_2 in BrF_3, 10 mol.% BrF_5 in BrF_3, and 10 mol.% UF_6 in BrF_3. Inconel and Duranickel also proved satisfactory. Stainless steel, mild steel, Mg, and Al are suitable for less critical applications. Nicloy-9 was totally unsatisfactory. Among the Ag solders tested, American Platinum Works Silvaloy 355 far excelled the others in its corrosion resistance toward BrF_3. The corrosion rate of Monel in aqueous $Al(NO_3)_3$ solutions exhibited a strong pH dependence, especially in the tests at higher temperatures. It was also observed that prior contact with BrF_3 reduced the corrosion of Monel by $Al(NO_3)_3$ solutions. The addition of small amounts of NH_2SO_3H to the $Al(NO_3)_3$ solution markedly inhibited the corrosion of Monel at low pH values and a temperature of 70°C. This effect persisted up to 4 days, depending upon the initial NH_2SO_3H concentration. Tests on the high Ni alloys (Ni, Monel, K. Monel, and Inconel) subjected alternately to BrF_3 and aqueous $Al(NO_3)_3$ solutions showed penetrations of 4 to 5 × 10^{-3} mil/cycle. (auth)

Refer also to abstract 4893.

GRAPHITE

4541 HW-37376

Hanford Atomic Products Operation, Richland, Wash.

THERMAL ANNEALING KINETICS OF C_0 SPACING DAMAGE IN IRRADIATED GRAPHITE. R. E. Nightingale. June 20, 1955. 8p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

The increase in the interlayer distance of the crystal lattice in radiation damage of graphite was studied. The interlayer distance may be annealed out by heating the damaged crystal to high temperature. The rate of annealing at several constant temperatures was determined. (F.S.)

Refer also to abstract 4988.

LABORATORIES AND EQUIPMENT

4542 CVAC-264R

CONVAIR, Fort Worth, Tex.

IRRADIATED MATERIALS LABORATORY OPERATIONAL PROCEDURES. S. V. Castner and F. L. Paschal. Oct. 15, 1954. 35p. Contract AF33(038)-2117. (FZR-9-055(Rev. 1)).

In order to eliminate or reduce the health hazards, an operational procedure was developed for the Irradiated Materials Laboratory. Major objectives of the procedure are to provide the methods and controls required to perform necessary tests on irradiated materials, prevent the spread of contamination, lower the effective dose rate to personnel, and prepare for emergency maintenance. (auth)

4543 NRL-4653

Naval Research Lab., Washington, D. C.

THE MAGNETIC PARTICLE CLUTCH AND ITS APPLICATION TO SERVOMECHANISMS. W. P. Jones. Oct. 5, 1955. 24p. Project No. NS-678-100.

A study of various clutch configurations reveals that for minimum inertia the magnetic particle clutch should employ a coil which is located externally with respect to the remainder of the clutch. This external coil allows the output member to be made of a low-inertia thin-walled cylinder. The coil configuration may be of the salient pole or of the toroidal coil structure. Calculated data indicate that, for clutches with high torque-to-inertia and high dissipation-power-to-torque ratios, the salient pole structure is preferable to the toroidal coil structure when weight and space are important. In a unique application of clutches as the prime mover in a servomechanism, it was found that the magnetic particle clutch shows an advantage over a servo motor of comparable rating in regard to control power and response time. (auth)

4544

A REMOTE VACUUM-OPERATED PIPETTE CONTROLLER. Evan Wright (Wallaceville Animal Research Station, Wellington, New Zealand). Atomics 7, 30-1, 37(1956) Jan.

MOLECULAR STRUCTURE

4545 AD-68570

Linden Labs., Inc., State College, Penna.

STUDY OF THE REACTIVITY OF SOLIDS. Final Progress Report for May 1, 1954–April 30, 1955. P. Lagally, W. Weyl, R. Brown, and K. Forland. June 10, 1955. 89p. DA Project 504-10-001. Contract DAI-28-017-501-ORD-(P)1405.

An investigation of the formation mechanism for the first H_2O layer on hygroscopic salts was extended to KF crystals. A comparison of the NaCl and KF mechanism as revealed by surface resistance measurements is given. No appreciable difference in the two was found. A study of the halochromic behavior of diphenylthiovioluric acid and its alkali salts was made. The color of the salts was found to be a function of the cationic force field. Methods of salt

preparation and molecular structure are given. A review of literature on the decomposition and detonation properties of azides was made to establish the contributing factors. Cation polarizability is suggested as a prime contributor to azide sensitivity. Anionic replacements were found to provide a means of reducing PbN_6 sensitivity. A summary of solid reactivity is included which discusses the screening demand of cations, alkali ions in organic compounds, effects of surface screening on stability, hydroxide glow phenomena, elemental O_2 reactivity, hygroscopicity and deliquescence, effects of hydrostatic pressure on atomic structure, and the crystal chemistry of detonators. (D.E.B.)

RADIATION CHEMISTRY

4546 OSR-TN-55-164

Princeton Univ., N. J. Forrestal Research Center.
THE REACTIONS OF ATOMIC HYDROGEN WITH OZONE AND WITH OXYGEN. Technical Note No. 19. J. D. McKinley, Jr., and David Garvin. May 1955. 23p. Chemical Kinetics Project. Contract AF33(038)-23976.

The reactions of oxygen and ozone with atomic hydrogen at room temperature have been studied in a low pressure flow system and the products (trapped at liquid N_2 temperature) have been determined. The yields of H_2O, H_2O_2 and "evolved" O_2 under various operating conditions are compatible with the view that product formation occurs primarily by radical recombination reactions in the cold trap. Hydroxyl is the immediate precursor of all water formed (and of a small amount of peroxide) while the fate of perhydroxyl is the formation of H_2O_2 (in the cold trap) and either hydroxyl or molecular oxygen in the pre-trap phase. (auth)

4547

THERMAL INITIATION OF VINYL POLYMERIZATION BY CERIC SOLUTIONS. Jerome Saldick (Brookhaven National Lab., Upton, N. Y.). J. Polymer Sci. 19, 73-5(1956) Jan.

Acid solutions of ceric perchlorate, nitrate, and sulfate initiated vinyl polymerization in the dark, via a normal free-radical mechanism. (auth)

RADIATION EFFECTS

4548 WADC-TR-55-461

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
GAMMA RAY INDUCED ADDITION OF BROMOTRICHLOROMETHANE TO OLEFINS. [Period covered] March 1955 to June 1955. A. M. Lovelace and D. A. Rausch. Apr. 1956. 13p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS.

A new technique in organic synthesis has been applied to the preparation of intermediates for monomers to be used in the polymerization of new cations in military aircraft. The addition of bromotrichloromethane to olefins has been effected with γ radiation. The well-known free radical addition of bromotrichloromethane to olefins has been studied utilizing Co^{60} as the energy source for the generation of free radicals. It has been found that addition reactions can be conducted in this manner resulting in good yields of the simple one to one addition products. No unexpected side reactions have been encountered and the adducts of bromotrichloromethane with 1-octene (85%), allyl chloride (51%), vinylacetate, (70%), cyclohexene (65%) and vinyltrichlorosilane (47%) have been obtained in the yields shown after radiation dosage of 2.25×10^5 roentgens (30 min exposure). In all cases the resulting products were shown to be identical with those reported by other investigators using organic peroxides or ultraviolet light. Using the system of bromotrichloromethane and 1-octene a study of the dependency of yield on radiation dosage was carried out. The variation in molar ratio of the reactants was shown to give a good yield (74%) of 1,1,1-trichloro-3-bromononane even when an equi-molar mixture of the methane and olefin was used. (auth)

4549

A STUDY OF THE IRRADIATION OF CATALASE BY IONIZING RADIATIONS IN THE PRESENCE OF CYSTEINE, CYSTINE AND GLUTATHIONE. W. M. Dale and C. Russell (Christie Hospital and Holt Radium Inst., Manchester, England). Biochem. J. (London) 62, 50-7(1956) Jan.

Catalase has been irradiated with x-rays, γ-rays and electrons from a linear accelerator and the effects on the activity, electrophoretic and chromatographic behavior, and the ultraviolet spectrum of the enzyme were examined. It has been found that irradiation causes a profound change in these properties, but that these changes are decreased by the presence of cysteine, cystine, and glutathione during irradiation. In the estimation of the catalatic activity in the presence of these substances allowance must be made for the depressive effect they have on the enzymic activity. Some aspects of this depression have been investigated. (auth)

4550

PRECISION MEASUREMENT OF DIMENSIONAL CHANGES IN BERYLLIA ON NEUTRON IRRADIATION. G. E. Bacon and S. A. Wilson (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Cryst. 8, 844-5(1955) Dec.

RARE EARTHS AND RARE-EARTH COMPOUNDS

4551 ISC-637

Ames Lab., Ames, Iowa.
THE USE OF CHELATING AGENTS IN THE SEPARATION OF THE RARE EARTH ELEMENTS BY ION-EXCHANGE METHODS. E. J. Wheelwright and F. H. Spedding. June 1955. 90p. Contract W-7405-Eng-82. $0.50(OTS).

A rapid method for separating rare earths into enriched fractions has been developed. The process consists of complexing part of the rare earths in a mixture—those rare earths which form the more stable complexes—with EDTA and separating the complexed rare earth ions from the uncomplexed rare earth ions by passing the mixture through an ion-exchange column in the ammonium cycle. The complexed ions pass through the resin bed, but the uncomplexed ions are adsorbed. A method has been found for separating pure rare earths in multigram quantities from rare earth mixtures. The method consists of eluting a band of mixed rare earths, adsorbed on a cation-exchange resin, through a second cation-exchange resin bed in the Cu^{2+} or Fe^{3+} state. Copper was found to be far superior to iron. The eluant consists of an NH_3-buffered solution of ethylenediaminetetraacetic acid. The elution of a mixture of all the rare earths down an ion-exchange bed with an NH_3-buffered solution of HEDTA indicated that this chelating agent is not as effective for separating the heavy rare earths as the EDTA-Cu^{2+} system under the conditions tested. (auth)

4552

ELECTROCHEMICAL STUDIES IN THE RARE EARTH SERIES. PART I. RARE EARTH OXALOACETATES. E. Gelles and G. H. Nancollas (Univ. of Glasgow, Scotland). Trans. Faraday Soc. 52, 98-102(1956) Jan.

Thermodynamic equilibrium constants for the association of La, Gd, Y, Dy, and Lu ions with oxalacetic acid in aqueous

solution have been obtained from potentiometric measurements at 25°C over a range of concentration and pH. (auth)

4553

MAGNETOCHEMISTRY OF ADSORPTION OF RARE EARTH IONS ON SILICA GEL. C. M. French and J. P. Howard (Queen Mary Coll., London). Trans. Faraday Soc. 52, 102-6(1956) Jan.

The adsorption from solutions of rare-earth salts on to silicic acid gel has been studied magnetochemically. The validity of an additivity relationship for the calculation of the magnetic susceptibility of the adsorbed ion has been confirmed. (auth)

SEPARATION PROCEDURES

4554 CEI-69

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PULSE AMPLITUDE AND FREQUENCY EFFECTS IN A PULSED PACKED COLUMN. S. H. Russell. Apr. 1954. 23p.

The effects on the efficiency and capacity of applying pulses of varying amplitude and frequency to a packed column were studied. In the efficiency studies, the maximum efficiency was obtained with a pulse having an amplitude of 3/8 in. and a frequency of 140 cycles/min. Under these conditions, the column was about five times as efficient as a simple packed column. Two general types of results were obtained in the capacity studies. Under certain conditions, the capacity increased over that of a simple packed column, but under others, it decreased. (auth)

4555

PYROPROCESSING FOR NUCLEAR FUELS. Robert C. Reid and J. Edward Vivian (Massachusetts Inst. of Tech., Cambridge) and Dick Duffey (Univ. of Maryland, College Park). Nucleonics 14, No. 2, 22-5(1956) Feb.

Pyroprocessing of nuclear fuels by molten metal or fused-salt extraction and slagging, is offered as a more convenient and less expensive method than the currently used aqueous process. The basic components of a pyroprocessing system are outlined. (D.E.B.)

4556

CHEMICAL PROCESSING IN THE NUCLEAR POWER INDUSTRY. I. IMPLICATIONS OF RECENT TRENDS IN REACTOR DEVELOPMENT. F. S. Martin and G. L. Miles (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 14-23(1956) Jan.

Trends in nuclear reactor development and associated fuel processing requirements are discussed. Different types of process for the recovery of nuclear fuel are considered, together with criteria for their selection. (auth)

4557

PERFORMANCE OF A PULSED SPRAY COLUMN. C. J. Billerbeck, Jack Farquhar, III, R. C. Reid, J. C. Bresee, and A. S. Hoffman (Massachusetts Inst. of Tech. Engineering Practice School, Oak Ridge, Tenn.). Ind. Eng. Chem. 48, 183-7(1956)

A study of the effect of pulse frequency and throughput on the operation of a simple pulsed spray column was made. The system employed was water–acetic acid–methyl isobutyl ketone which has been used for liquid-liquid extraction studies. (auth)

4558

PROTACTINIUM. I. ANALYTICAL SEPARATIONS. J. Golden and A. G. Maddock (Radiochemical Lab., Cambridge, England). J. Inorg. and Nuclear Chem. 2, 46-59(1956) Jan.

The conditions for the separation of Pa from other elements by solvent extraction of a chloride complex by diisopropyl ketone have been investigated. The complex appears to contain three molecules of the solvent. Its heat of formation is small. Evidence for the existence of a sparingly soluble salt $BaPaF_7$ is advanced. (auth)

Refer also to abstracts 4540 and 4551.

SORPTION PHENOMENA

4559

ON THE NATURE OF SLOW GAS SORPTION BY SOLID BODIES. M. I. Temkin and N. V. Kul'kova. Doklady Akad. Nauk S.S.S.R. 105, 1021-3(1955) Dec. 11. (In Russian)

The porous sorption of oxygen on Ag at 250° was measured. The chemical and activated sorptions at various temperatures are discussed. (R.V.J.)

SYNTHESES

4560 WADC-TN-55-150

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

CONTRACTORS' MEETING, POLYMER SECTION, ORGANIC MATERIALS BRANCH. W. H. Ebelke. May 1955. 25p. (AD-71554).

Problems connected with the synthesis of thermally stable compounds for use as synthetic rubbers, sealants, structural laminating resins and adhesives, protective coatings, dielectrics, hydraulic fluids, lubricants, and other related materials for use as base stocks in specialized Air Force applications were discussed. The topics discussed included the synthesis of fluoroelastomers, fluorochemicals, and semi-organic polymers; inorganic polymers; and high-temperature fluids and related problems. Abstracts of the papers presented are attached as appendices. (C.H.)

4561 AEC-tr-2477

MICROSYNTHESIS OF VARIOUS I^{131} LABELED IODOTHYRONINES. J. Roche, R. Michel, P. Jouan, and W. Wolf. Translated by Gretchen R. Riese from Bull. soc. chim. biol. 37, 819-29(1955). 14p.

The microsynthesis of the I^{131}-labeled iodothyronines (3,3′-diiodothyronine, 3,3′,5′ and 3,5,3′-triiodothyronine, and 3,5,3′,5′-tetraiodothyronine) are described. The iodides coming from substitution reactions are first eliminated by iontophoresis in presence of a volatile buffer at pH 8.5; the various iodothyronines are then separated by paper chromatography in presence of ammoniacal t-amyl alcohol. Yields are 20 to 50% of theoretical values. (auth)

4562 AERE-Lib/Trans-650

AMIDES AND NITRIDES. PART II. NITRIDES. R. Juza. Translated by F. Hudswell from First Review of German Science, 1939-46: Inorganic Chemistry, p.64-71. 8p.

4563

SYNTHESIS OF DISACCHARIDES WITH PEA PREPARATIONS. R. C. Bean and W. Z. Hassid (Univ. of California, Berkeley). J. Am. Chem. Soc. 77, 5737-8(1955).

Refer also to abstract 4520.

TRACER APPLICATIONS

4564

ANNUAL REPORT OF THE RESEARCH COMMITTEE ON THE APPLICATION OF ARTIFICIAL RADIOACTIVE ISOTOPES IN JAPAN. VOL. I, PART 2. (Collected Re-

prints). Tokyo, Japan Society for the Promotion of Science, Dec. 1951. 162p.

Chemical studies are summarized which were carried out in Japan during 1951 in which radioactive isotopes were used as tracers. (In English and Japanese.) (C.H.)

4565

ANNUAL REPORT OF THE RESEARCH COMMITTEE ON THE APPLICATION OF ARTIFICIAL RADIOACTIVE ISOTOPES IN JAPAN. VOL. II. Tokyo, Japan Society for the Promotion of Science, Mar. 1954. 164p.

Chemical and biological studies are summarized which were carried out in Japan during 1952 in which radioactive isotopes were used as tracers. (C.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

4566 LA-1975

Los Alamos Scientific Lab., N. Mex.

PURIFICATION OF GRAM AMOUNTS OF AMERICIUM. J. S. Coleman, D. E. Armstrong, L. B. Asprey, T. K. Keenan, L. E. LaMar, and R. A. Penneman. Nov. 1955. 39p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00 (mf OTS).

Methods of Am purification are discussed under three classifications: ion exchange, solvent extraction, and precipitation. Two new ion-exchanger processes for the separation of Am from rare earths are described in detail. The first involves absorption of rare earths and Am on a column of hydrogen-form cation exchanger, followed by elution with 0.1% ammonium citrate, pH 8. The second utilizes the marked tendency of strongly basic anion exchangers to absorb Am in preference to the rare earths from ammonium thiocyanate solutions. Solvent extraction with TBP is recommended for gross decontamination of Am crudes, and oxidation-reduction cycles suitable for final purification of Am concentrates are outlined. (auth)

4567

THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART I. PLUTONIUM HYDRIDE. F. Brown, Heather M. Ockenden, and G. A. Welch (United Kingdom Atomic Energy Authority (Industiral Group, Windscale Works, Cumberland, England). J. Chem. Soc., 3932-6(1955) Nov.

Plutonium hydride with the approximate composition $PuH_{2.7}$ has been obtained by direct combination of Pu with H_2 at temperatures between 150 and 250°C. Its chemical properties have been found to be very similar to those of Pu. By means of a thermobalance the hydride has been found to be stable in air up to 150°C. X-ray-diffraction photographs showed two patterns, one of which was cubic and similar to that of PuO_2, and the other hexagonal. (auth)

Refer also to abstract 4531.

URANIUM AND URANIUM COMPOUNDS

4568 CF-53-10-86

Oak Ridge National Lab., Tenn.

PRELIMINARY MEASUREMENTS OF THE DENSITY AND VISCOSITY OF COMPOSITION 43 (Na_2UF_6). S. I. Cohen and T. N. Jones. Oct. 14, 1953. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The density of composition #43 (Na_2UF_6 may be represented by $\rho(g/cm^3) = 5.598 - 0.00119T$ where 660° < T < 1000°C; the viscosity varied from about 9.9 centipoises at 975°C to about 17.5 centipoises at about 725°C. (auth)

4569 CF-54-10-86

Oak Ridge National Lab., Tenn.

DENSITY AND COST RELATIONS FOR D_2O AND SOLUTIONS OF UO_2SO_4 IN D_2O. TBR Memorandum No. 2. A. L. Gaines. Oct. 14, 1954. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Density and cost relationships for D_2O and solutions of UO_2SO_4 in D_2O as a function of temperature and concentration of U in solution are graphically presented. (C.W.H.)

4570 CF-55-3-110

Oak Ridge National Lab., Tenn.

RAW MATERIALS ECONOMIC STUDIES: A PRELIMINARY ESTIMATE OF THE COST OF SOLVENT EXTRACTION USING AMINE REAGENT. B. B. Klima, W. T. Ward, and R. R. Wiethaup. Mar. 21, 1955. Decl. Apr. 4, 1956. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

4571 CF-55-3-193

Oak Ridge National Lab., Tenn.

RAW MATERIALS ECONOMIC STUDIES: PRELIMINARY ESTIMATE OF THE COST OF URANIUM EXTRACTION FROM SIXTY PERCENT SLURRY USING D2EHPA REAGENT. B. B. Klima, W. T. Ward, and R. R. Wiethaup. Mar. 31, 1955. Decl. Apr. 4, 1956. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

4572 CF-56-5-134

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROCESS TESTING. Engineering Section Progress Report [for] February 1956. A. D. Ryon and K. O. Johnson. May 17, 1956. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Chloride ion was shown to lower the U extraction efficiency in the Amex Process. The maximum loadings of U, Mo, and V in specific organic solutions were studied. Wet screen analyses were made on the leached solids from several U ores. (C.W.H.)

4573 IDO-14366

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

URANIUM DETERMINATION BY THE ISOTOPE DILUTION TECHNIQUE. [PART] II. Paul Goris and F. H. Tingey. Apr. 17, 1956. 11p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Overall errors at the 95% limits for the isotope dilution technique as applied to plant feed samples are as follows: Concentration ±5.8%, $\%\ U^{235} \pm 0.42$. The isotope dilution technique for U concentration and mass assay is applicable with the present mass spectrometers in the range 356 to 0.001 mg U/ml. Mass assay results at the lower level become less reliable and serve only as estimates for the abundant isotopes in the sample. Concentrations can be determined with reasonable precision throughout the range. (auth)

4574 ORNL-1949

Oak Ridge National Lab., Tenn.

COST OF URANIUM RECOVERY BY THE AMINE EXTRACTION PROCESS. B. B. Klima, H. M. McLeod, Jr., A. D. Ryon, and R. R. Wiethaup—K. O. Johnson, ed. Sept. 8, 1955. Decl. Jan. 10, 1956. 39p. Contract W-7405-eng-26. $0.30(OTS).

The estimated costs of uranium recovery from clarified H_2SO_4 leach liquor by the Amine Extraction Process are outlined. At a production rate of 200 tons of ore/day the estimated costs are $0.67/lb U_3O_8 with no secondary strip and $0.72/lb U_3O_8 with 100% secondary strip. These costs include direct operating costs and amortization but no overhead; they also include the processing steps associated with clarification, solvent extraction, U precipitation, calcination, and product packaging. (C.W.H.)

4575 TID-8011

Technical Information Service, AEC.

THE FIRE PROPERTIES OF METALLIC URANIUM. R. B. Smith, Safety and Fire Protection Branch, Div. of Organi-

zation and Personnel, AEC. Apr. 12, 1956. 12p. $0.20 (OTS).

One of Its Monograph Series "The Industrial Atom."

Under suitable conditions, uranium is capable of self-sustaining combustion in air, N_2, O_2, and CO_2; the reaction is accompanied by emission of very intense but localized heat and light. Factors contributing to uranium pyrophoricity are discussed and a reaction mechanism involving surface hydride formation is outlined. Uranium–water reactions were also investigated. (auth)

4576 AERE-Lib/Trans-584

THE DIFFUSION OF NOBLE-GAS FISSION PRODUCTS IN URANIUM. K. E. Zimen and P. Schmeling. Translated by F. Hudswell from Z. Elektrochem. 58, 599-601(1954). 4p.

4577

THE OXIDES OF URANIUM. PART VI. THE CHEMISORPTION OF REDUCING GASES ON URANIUM AND THORIUM DIOXIDES. L. E. J. Roberts (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3939-46(1955) Nov.

Carbon monoxide is chemisorbed by UO_2 and by ThO_2 temperatures below 20°C. There is mutual interference between the adsorption of O_2 and CO on UO_2 at low temperatures. The adsorption of CO by UO_2 at higher temperatures is small. Hydrogen is not appreciably chemisorbed by UO_2 below 400°, but at higher temperatures an activated adsorption occurs and high surface coverages can be attained. The results are discussed in terms of the numbers and the nature of the adsorption sites available. (auth)

4578

THE OXIDES OF URANIUM. PART VII. THE OXIDATION OF URANIUM DIOXIDE. J. S. Anderson, L. E. J. Roberts, and E. A. Harper (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3946-59(1955) Nov.

Uranium dioxide is oxidized by two distinct processes in the temperature ranges −130 to 50°C and 130 to 180°C though in each case O_2 is absorbed into interstitial positions in the lattice. Between −130 and 50°C, the O_2 absorbed increases as the logarithm of the time; the same law is followed at the same temperatures by solid solutions of UO_2 and ThO_2. The oxidation virtually ceases at temperatures below 50° at a composition which depends upon the surface area of the UO_2. Between 130 and 180°C the kinetic law followed is characteristic of a diffusion-controlled process but both the rate of reaction and, to some degree, the composition of the oxide finally formed depend upon the pressure. The reaction with NO_2 is much faster than the reaction with O_2. (auth)

Refer also to abstract 4554.

WASTE DISPOSAL

4579 AERE-C/R-1861

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE TEMPERATURE DISTRIBUTION IN A HEATED CLAY BLOCK AND ITS APPLICATION TO THE PROBLEM OF FISSION PRODUCT DISPOSAL. C. B. Amphlett and D. T. Warren. Feb. 1956. 9p. (FPSD/P-11).

The heating produced in a large volume of clay by a highly-active fission-product source at its center has been simulated by means of a furnace placed in the center of a large block of clay. Temperature-distribution curves are given, and the significance of the results in relation to the self-fixation of fission products by radioactive heating is indicated. A general account is also given of the effects produced on heating natural clays to high temperatures. (auth)

4580 AERE-C/R-1862

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE POSSIBILITY OF SELF-FIXATION OF HIGHLY ACTIVE WASTES. C. B. Amphlett. Feb. 1956. 8p. (FPSD/P-12).

This report summarizes the uses of siliceous minerals to absorb activity either by ion exchange or by firing to produce mixed silicates. It is concluded that ion-exchange methods are best suited to fairly pure active materials in solution, but that the alternative process offers promise for absorption and fixation in solid form of bulk highly active wastes containing large proportions of inactive contaminants and of acid. It may also be applicable to solid wastes and suspensions. (auth)

4581 CF-55-1-200

Oak Ridge National Lab., Tenn.

REMOVAL OF RADIOACTIVE CONTAMINANTS FROM WATER BY ION EXCHANGE SLURRY. William J. Lacy and Don C. Lindsten. Jan. 25, 1955. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The removal of radioactive contamination from H_2O by ion exchange materials is determined by the total dissolved salt content of the water, ionic or colloidal state of the contaminant, type of ion exchange material, chemical valence of contaminant, and other factors. Tests indicated that under certain conditions the ion exchange batch slurry treatment decontaminates radioactively contaminated H_2O to a level suitable for emergency drinking purposes within 15 min. (C.W.H.)

4582 CF-55-5-171

Oak Ridge National Lab., Tenn.

PRELIMINARY LABORATORY EVALUATION OF AN ELECTRODIALYTIC METHOD FOR THE TREATMENT OF RADIOACTIVE WATERS. M. S. Seal and D. A. Pecsok. May 18, 1955. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An electrodialytic method using ion exchange membranes is described which has been used for the decontamination of radioactive wastes and for the concentration of radioelements contained in low-level radioactive waters. The application of this method for decontamination purposes is of interest in the treatment of low-level radioactive wastes or in the treatment of drinking water supplies which have been rendered unsafe through radioactive contamination. The use of the method for concentrating contaminants contained in a solution is of particluar importance where radiochemical analyses of low-level wastes are required. (C.H.)

Refer also to abstract 4611.

ENGINEERING

4583 CF-52-7-167

Oak Ridge National Lab., Tenn.

VALUE OF MONEY—EQUIVALENCE. H. E. Schweyer. July 1, 1952. 22p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Applications to process equipment of engineering economic equations and simplified methods of calculations are illustrated. Money as capital put to work, the amounts earned, the different method of payment resulting in difference in dollars paid, as value of money-equivalence, are discussed. (R.V.J.)

4584 NP-5975

Callery Chemical Co., Penna.

EXTINGUISHING SODIUM–POTASSIUM ALLOY FIRES. R. E. Lee. Sept. 14, 1954. 3p. (SP-119).

The most effective method for extinguishing a NaK fire is to remove the oxygen by blanketing it with Met−L−X, graphite, or soda ash. The residue consisting of NaK, hydroxides, oxides and the blanket material should be put in a container with a lid and then disposed of in an isolated area. (F.S.)

4585 WADC-TR-55-87

Franklin Inst. Labs. for Research and Development, Philadelphia.

TREATMENT OF METAL SURFACES FOR ADHESIVE BONDING. Samuel N. Muchnick. Feb. 1955. 68p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: STRUCTURAL ADHESIVES. Contract AF33(616)-2347. (AD-66772).

A theoretical basis is presented for the adhesion of a metal to an organic bonding agent. The contact angle is shown to be an effective measure of the adequacy of a surface treatment for a metal surface. For example, when a water drop makes a low or a zero contact angle on an Al or a stainless steel surface immediately following a surface treatment, joint strength is generally at a maximum and most likely to be reproducible. A study has been made of the importance of the film adsorbed on the metal surface and of the mechanical properties of the metal as they are related to nominal joint strength. Four different adhesives have been used to evaluate the surface treatments which result in the highest joint strengths. In addition, those procedural variables are investigated which might affect surface properties and joint strength. (auth)

4586 WADC-TR-56-224

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

HIGH TEMPERATURE LUBRICANT STUDIES. E. Erwin Klaus and Merrell R. Fenske. May 1956. 33p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contract AF33(616)-2851.

Viscosity properties, lubricity, thermal stability, oxidation, and corrosion of silicones, silicates, hydrocarbons, diesters, and halogenated aromatic hydrocarbons from 500 to 700°F were evaluated in a high-temperature lubricant study. (F.S.)

HEAT TRANSFER AND FLUID FLOW

4587 AERE-ED/M-27

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NOTE ON DENSITY RELATIONSHIPS IN BOILER TUBES. P. Fortescue. Oct. 4, 1955. 6p.

A quantity of greater importance than tube exit density in boilers is the mean tube density, since this determines the natural circulation potential, and the reactivity, in the case of a boiling reactor. Where bubble slip and secondary effects of tube pressure drop can be neglected, and there is zero initial subcooling, there exists an extraordinarily simple relationship between exit and mean tube density. (auth)

4588 CF-53-4-113

Oak Ridge National Lab., Tenn.

ELECTRICAL AND THERMAL CONDUCTION. PART 1. ELECTRICAL CONDUCTION. J. G. Daunt. [Apr. 1953]. 96p. Contract [W-7405-eng-26]. $15.30(ph OTS); $5.40 (mf OTS).

Theories of electrical conduction, the classical free electron gas, the classical theory, Sommerfeld's free electron gas, and Bloch's and Mott and Baber's theories are discussed. The effects of impurities on electrical resistivity of metals are analyzed. Theoretical aspects, applicability of Matthiessen's Rule in "pure" samples, and experiments in dilute solid solutions of Cu, Ag, Au, and Ag−Mn were checked. Permanent deformation produced by cold work was studied in Ag, Au, Cu, and Al in polycrystalline form at temperature down to 20°K. The thermal effects on electrical resistivity were investigated, tabulations being given for Cu, Au, Pd, Pt, W, and Pb temperature dependence at relatively high temperature, and for Li, Na, K, Rb, Cu, Ag, Au, Pb, Sn, Su, Cd, W, and Sr electric resistivity at low temperature. Resistivity minima at very low temperature have been established for Mg, Ag, Cu, and Au. The magneto-resistive effects, the general fields, and the temperature dependence are described, as well as the theoretical considerations, and observation at low temperatures. The effect of size in electrical resistivity, the theory of small specimen resistance, and the results of increased electric resistance of small specimens, films, foils, and wires of Au, Cd, Hg, and Pb and the magnetic effects in the conductors of small size were calculated. A brief outline is given of the theory of anomalous skin depth effects with evaluation tables for the measured surfaces of specimens. (R.V.J.)

4589 CF-55-1-104

Oak Ridge National Lab., Tenn.

BOILING EXPERIMENT TRANSIENT EFFECTS. M. Richardson and L. G. Alexander. Jan. 11, 1955. 13p. Contract [W-7405-eng-26]. $3.80(ph OTS); $2.40(mf OTS).

A preliminary investigation of transient effects to power, pressure, and flow of unsteady boiling conditions was made. These experiments indicate substantial equilibrium of circulation rate and driving forces. (D.E.B.)

4590 CF-55-7-52

Oak Ridge National Lab., Tenn.

PHYSICAL PROPERTIES AND HEAT TRANSFER CHARACTERISTICS OF AN ALKALI NITRATE−NITRITE SALT MIXTURE. H. W. Hoffman. July 21, 1955. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The physical properties, heat transfer characteristics, and corrosive behavior of HTS (40 wt. % $NaNO_2$−7 wt. % $NaNO_3$−53 wt. % KNO_3) are summarized. The radiation stability of HTS is also discussed. (C.W.H.)

4591 EES-030067

Naval Engineering Experiment Station. Mechanical Lab., Annapolis.

PERFORMANCE TEST OF ROSS JACKET WATER COOLER FOR DIESEL ENGINES SUBMITTED BY THE ROSS HEATER AND MANUFACTURING COMPANY, BUFFALO, NEW YORK. Stephen H. Ford, Jr. July 3, 1953. 11p.

A diesel engine jacket water cooler was submitted for test to determine its compliance with performance requirements of the contract. Test results indicated that the unit exceeded the performance requirements, as demonstrated by greater heat removal capacity and lower water friction losses. (auth)

4592 EES-5NX1609

Naval Engineering Experiment Station. Wave Mechanics Lab., Annapolis.

REPORT OF SHOCK TEST OF A HEAT EXCHANGER FOR BATTERY COOLING WATER MANUFACTURED BY ROSS HEATER AND MANUFACTURING CO., INC. C. B. Allison. Sept. 5, 1950. 6p.

Shock tests were made on a Ross heat exchanger for battery cooling water. Deformation of the mounting feet and stretching of the mounting bolts was sustained by the equipment as a result of shock. The manufacturer has proposed certain design changes to improve the shock resistance of the equipment. The unit with the proposed modifications is recommended for high-impact shock service. (auth)

4593 IGR-TN/W-306
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE EFFECT OF A VARIABLE HEAT FLUX ON THE HEAT TRANSFER COEFFICIENT. T. Burgoyne. Mar. 28, 1956. 21p. (IGC-NPCC-FEWP/P-42).

Primary considerations show that the heat transfer coefficient may be affected by a changing heat flux along the length of a pipe. Measurements of the heat transfer from a stainless steel tube, in which the heat flux varies along the axis, confirm this view and indicate useful scope for further investigation. (auth)

4594 NP-5862
Stanford Univ., Calif.
A SUMMARY OF EXPERIMENTS AND ANALYSIS FOR GAS FLOW HEAT TRANSFER AND FRICTION IN CIRCULAR TUBES. Including a consideration of: a. TEMPERATURE DEPENDENT GAS PROPERTIES. b. INFLUENCE OF ENTRANCE LENGTH AND TYPE OF ENTRANCE. c. TRANSITION REGION BEHAVIOR. Technical Report No. 22. W. M. Kays. June 30, 1954. 82p. Contract N6-onr-251, Task Order 6.

Work accomplished on the heat transfer and flow friction behavior for gas flow inside circular tubes is summarized. Experimental data are presented supplementing the data previously presented. An analysis of the effects of temperature dependent gas properties covers both laminar and turbulent flow. The effects of the (L/D) ratio of the tubes is considered, based on experimental data available in the literature. A large amount of experimental data in the transition region is critically examined. Methods are proposed for accounting for the influence of temperature dependent properties, and also (L/D), by simple correction factors to the correlations for constant property flow in long tubes. Complete algebraic correlations are then proposed, for both heat transfer and friction, which include all of the important variable for gas flow at moderate Reynolds numbers in small circular tubes. A set of design curves are presented, giving both heat transfer and friction behavior in the Reynolds number range, 500 to 50,000, and including all of variables considered. (auth)

4595 OSR-TN-55-340
Princeton Univ., N. J. Forrestal Research Center.
THE CRITICAL STUDY OF A BOUNDARY CONDITION ON PRANDTL'S BOUNDARY LAYER THEORY AND ITS APPLICATIONS. Report No. 329. Sin- I Cheng. Sept. 1955. 42p. Project R-352-20-9. Contract AF18(600)-498. (AD-74767).

It is shown how the physical argument of similitude or qualitative experimental information can be circumvented in constructing the boundary layer solutions. The necessity of additional assumptions or informations is regarded as due to the incomplete mathematical formulation of Prandtl's boundary layer theory. The absence of longitudinal diffusion of vorticity according to the boundary layer theory does provide an x-wise boundary condition which leads to a unique determination of the x-wise expansion parameters for constructing the downstream boundary layer solution. The ordinary subsonic and supersonic steady boundary layer problems for a thin body in a uniform stream are discussed, and different types of series expansions are deduced for different types of inflow. The steady hypersonic boundary layer problems are treated next and proper series expansions are determined without making any assumption with regard to the matching procedure etc. The results of applying this method to unsteady problems are quoted from references (4) and (7), and briefly discussed as to its important consequences. The generality of the principle and the method involved seems to suggest that this boundary condition be supplemented to the mathematical formulation of Prandtl's boundary layer theory. This supplement appears necessary not only from the mathematical point of view but also from the physical point of view that the boundary layer theory should suffice a solution without additional physical arguments. (auth)

4596 NACA-TM-1400
BOUNDARY LAYER. (Pogranichnyi sloi). L. G. Loitsianskii. Translated by S. Reiss from Mechanics in the U.S.S.R. over Thirty Years, 1917-1947, p.300-20. 29p.

The most important results by Soviet scientists in the development of the theory of the boundary layer are enumerated. Included are discussions of the laminar boundary layer for the case of plane-parallel motion of incompressible fluid, the turbulent boundary layer for the same case, and the boundary layer and resistance in compressible gas at large velocities. (B.J.H.)

4597 NP-5966
Delaware. Univ., Newark.
AGITATION OF NON-NEWTONIAN FLUIDS. Technical Report No. 2. A. B. Metzner and R. E. Otto. [1956]. 45p. Contract DA-36-034-ORD-1495.

A relationship between impeller speed and the shear rate of the non-Newtonian fluid was developed. Preliminary observations indicate that power requirements for rapid mixing of non-Newtonian fluids are greater than for comparable Newtonian materials. (C.W.H.)

4598 NP-5967
Delaware. Univ., Newark.
HEAT TRANSFER TO NON-NEWTONIAN FLUIDS. Technical Report No. 3. A. B. Metzner, R. D. Vaughn, and G. L. Houghton. [1956]. 46p. Contract DA-36-034-ORD-1495.

Variables controlling heat transfer rates to non-Newtonian fluids in the streamline flow region were studied. In limited cases these results were correlated with theoretical analyses to form a heat transfer theory applicable to Newtonian and non-Newtonian fluids. Some preliminary findings are outlined on problems of non-isothermal fluid flow pressure losses and heat transfer outside the laminar flow region. (C.W.H.)

4599 NP-5971
Bureau of Mines. Div. of Solid Fuels Technology, Pittsburgh.
FLOW PROPERTIES OF FINE PARTICLES. PART I. FLOW IN PNEUMATIC TRANSPORT SYSTEMS. Final Report [for] March 1, 1952—October 30, 1955. Murray Weintraub and James W. Myers. 157p. Contracts CD4-480, CD3-679, and CD2-4014.

An investigation has been conducted into the factors governing the flow of fine particles. The program has surveyed a broad field, and the experimental work has been extensive rather than intensive. Observations on the dense-phase flow of sand through horizontal and vertical tubes are reported and discussed. Horizontal aerated flow was investigated for 57-micron and 33-micron glass spheres, and for 1-micron magnesium silicate. The effects of air rate, solids rate, tube diameter, and tube length were studied, and tentative correlations are proposed. Related subjects that were investigated include the measurement of the size of small particles, fluidization and agglomeration of powders, and measurement of particle velocity and stream density. (auth)

4600 UCRL-3353
California. Univ., Berkeley. Radiation Lab.
VACUUM FLOW OF GASES THROUGH CHANNELS WITH CIRCULAR, ANNULAR, AND RECTANGULAR CROSS

SECTIONS (thesis). Walter Dong. Apr. 1956. 118p. Contract W-7405-eng-48. $0.60(OTS).

Equations for slip flow in annular and rectangular sections were derived. Also derived was an approximate slip-flow equation for annular sections that agreed well with the rigorous derivation for channels with ratios of radii greater than 0.5. A study of the effect of the molecular nature of the gas on slip flow indicated that with decreasing pressure a positive deviation of flow from the slip-flow equation results. This would explain the apparent decrease in f observed in the slip-flow region. A simple approximation of the flow in the molecular-flow region was given that consisted of adding to the self-diffusion solution at low Knudsen numbers an additional flow due to streaming. (auth)

4601 AERE-Lib/Trans-596
INVESTIGATION OF THE EFFECT OF THE RATE OF MOTION OF THE WATER CURRENT ON THE HEAT EXCHANGE COEFFICIENT ON BOILING IN AN INCLINED TUBE. V. V. Bagdanov. Translated by J. B. Sykes from Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 136-40 (1955). 8p.

4602
SHORTCUTS FOR TRANSIENT HEAT FLOW. Irving Granet and Robert M. Gould (Foster Wheeler Corp., New York). Chem. Eng. 63, No. 2, 183-6(1956) Feb.

Analytical and graphical methods for the solution to the problem in unsteady-state heat conduction are discussed. (auth)

4603
FILM BOILING OF WATER BY PULSE-HEATING SMALL WIRES. E. A. McLean, V. E. Scherrer, and C. E. Faneuff (Haval Research Lab., Washington, D. C.). J. Appl. Phys. 27, 193-4(1956) Feb.

Wires heated by square-wave power pulses of one μ sec were photographed with a synchronized camera. Photographs are given which support the speculation that film boiling is preceded by a dense population of nucleate bubbles. (D.E.B.)

Refer also to abstract 4937.

MATERIALS TESTING

4604 CAL-IG-842-M-13
Cornell Aeronautical Lab., Inc., Buffalo.
DESIGN AND DEVELOPMENT OF FATIGUE LIFE GAGE FOR METALS. Final Report. F. J. Gillig. Dec. 26, 1954. 39p. Contract NOa(s)-52-1127-c. (AD-57244).

A series of experiments were conducted with the purpose of devising a gage or indicator whereby the amount of remaining fatigue life in a structure or component could be estimated with a fair degree of accuracy. Three approaches were tried: (1) Using wires of materials that were different from that of the structure. (2) Making use of Miner's theory of cumulative fatigue damage. (3) Prestressing the indicator wires. It was demonstrated that the strain of a specimen when loaded can be transmitted to a bonded wire, thus enabling the parallelling in the wire the fatigue cycle of the specimen. As a result of the work to date, the most difficult problem is the interrelated one of fatigue scatter and the uniformity of properties of the wire. In this regard, it was found that process control of the wire can lead to significant reduction in scatter. It appears that the application of a current carrying wire bonded to a specimen or element of structure shows more immediate promise as a laboratory instrument than as a flight fatigue detector. (auth)

4605 NP-5969
Virginia. Univ., Charlottesville. Cobb Chemical Lab.
HIGH TEMPERATURE ANTIOXIDANTS IN SYNTHETIC FLUIDS. Quarterly Progress Report No. 2. James W. Cole, Jr. Apr. 1956. 20p. Project title: HYDRAULIC FLUIDS, LUBRICANTS AND RELATED MATERIALS. Task title: EVALUATION OF HIGH TEMPERATURE ANTIOXIDANTS IN SYNTHETIC FLUIDS. Contract AF33(616)-3234.

Oxidation runs have been made at 700°F for the purposes of comparing two phosphate fluids, MLO 9553 and MLO 9574, and the evaluation of selected additives in Silicone MLO 9840, Silicone MLO 53-446 and a tetra alkyl silane, MLO 54-408D. Of the two phosphates, tris-(m-chlorophenyl) phosphate, MLO 9553, appeared to be generally more stable in the presence of Ag, Al, Ti, and stainless steel. In the D.C. Silicone, MLO 9840, XF258, a number of additives showed promising activity. They seem to be mainly of the "hindered nitrogen" type or condensable to this configuration. Especially attractive were acridine, p-aminoacetanilide, diphenyl guanidine, n-phenylmorpholine, dipyridylamine, 1,5-diaminoanthraquinone, naphthylamine, and phenazine. Some of these additives were surprisingly effective in the presence of Al, Ag, stainless steel, Ti, and Cu. Additional work is needed to determine the optimum conditions to minimize sludge formation and separation of solids on cooling. In a few runs with the chlorophenyl silicone, MLO 53-446, many of the same additives showed some activity but the general stability was not encouraging. In a few runs with tetrakis n-dodecyl silane, MLO 54-408D, these types of additives looked promising, but this fluid refluxed significantly at 700°F. (For preceding period see CCL-6.1.) (auth)

4606 WADC-TR-53-426(Pt. 1)
Iowa State Coll., Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Henry Gilman, Robert K. Ingham, and Richard D. Gorsich. Apr. 1954. 12p. Contract AF33 (616)-94. (AD-41228).

A number of organo-metallic and organo-metalloidal compounds were screened for thermal stability in connection with high-temperature lubricants. The most effective materials tested thus far have been the tetrasubstituted silanes and compounds containing a Si–O bond. Among the more promising groupings are the 1-naphthyl, benzyl, and long-chained alkyl groups. The benzyl and long-chained alkyl groupings seem to give thermal stability at least equivalent to aryl groups while contributing toward a considerable lowering of the melting point for the compound. The germanium compounds tested thus far show promise; however, the organo-Sr and -Pb compounds appear useful only for obtaining comparative information concerning the various groups. Several classes of organo-Si, -Ge, -Sr, and -Pb compounds have been synthesized and tested for thermal stability. Information obtained from the screening of these compounds has been utilized for the design and syntheses of addition compounds and for the selection of compounds to receive further evaluation. (auth)

4607 WADC-TR-54-532(Pt. 2)
Monsanto Chemical Co., Dayton, Ohio.
HIGH-TEMPERATURE HYDRAULIC FLUIDS. PART 2. DEVELOPMENT OF BASE STOCK. [Period covered] November 1954 to July 1955. Edward S. Blake, James W. Edwards, William C. Hammann, and Thomas Reichard. Jan. 1956. 49p. Project and Task title: HYDRAULIC FLUIDS. Contract AF33(616)-2623.

Fifty compounds have been screened for thermal stability. Tert-alkylcarbinyl sebacates have been shown to be remarkably more stable (104 to 122°F) than n-alkyl sebacates. One new tert-alkylcarbinol, 2,2,4-trimethyl-1-pentanol, and eight new esters were synthesized. A polyarylphosphonate as a V. I. improver for thermally stable trialkylphosphate appeared to degrade on heating. A sufficient number of aromatic ethers were made and tested to reaffirm the high thermal stability of this chemical class and to indicate a high probability that the melting points of the aromatic ethers can be sufficiently lowered, without sacrifice in their thermal properties, to make them promising as base stock for high temperature functional fluids. (See also NP-5608.) (auth)

4608 WADC-TR-55-86(Pt. 2)
Minnesota. Univ., Minneapolis.
FATIGUE CRACK DETECTION METHODS. PART 2: REVIEW OF EXPERIMENTAL DATA ON THE INITIATION AND PROPAGATION OF FATIGUE CRACKS IN TEST SPECIMENS. [Period Covered] January through March 1955. L. J. Demer. June 1955. 77p. Project Title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE PROPERTIES OF STRUCTURAL MATERIALS. Contracts AF33(038)-20840 and N8-ONR-66207. (AD-75478).

Current fatigue literature contains numerous references to a few recent studies in which fatigue cracks have been detected very early in the specimen life. This paper attempts to clarify such isolated observations by making a detailed review of the available experimental data in relation to crack initiation and growth in laboratory fatigue test specimens. The data are analyzed considering the nature of the test material, the character of the specimen, the stress level of the test, and the manner of testing. Conclusions are reached in regard to the effect of these factors on the percentage of fracture cycles at which fatigue cracks are detected. The formula of A. K. Head for the actual growth of fatigue cracks is reviewed, and its agreement with experimental results is discussed. (auth)

4609 WADC-TR-55-190(Pt.2)
Continental Oil Co. [Central Research Labs.], Ponca City, Okla.
DEVELOPMENT AND EVALUATION OF A GREASE FOR −100°F TO +350°F. [Period covered] March 15, 1955 to December 15, 1955. Ernest W. Nelson, Warren W. Woods, C. Richard Bergen, William P. Scott, and Richard M. Tillman. Dec. 1955. 27p. Project title: AIRCRAFT LUBRICATING GREASES. Task title: WIDE TEMPERATURE RANGE GREASE. Contract AF33(616)-2364, Supplemental Agreement No. 52(55-987).

The thickener for the wide temperature range grease development was limited to a colloidal calcium carbonate coated with the calcium salts of aliphatic dicarboxylic acids. The aliphatic diesters were studied as possible base fluids. Although promising in many respects, their use is precluded because of high evaporation rates and lack of a sufficiently active oxidation inhibitor at 350°F. Greases prepared with certain hexa alkoxy disiloxanes appear promising. Formulations using the base oil hexa(2-ethyl hexoxy)disiloxane very nearly meet or surpass target requirements, the lone exception being high temperature performance. Here a maximum of 350 hr has already been achieved. Formulation changes designed to improve performance of such greases have been developed, but testing has been hampered because of the short supply of the base fluid. (auth)

4610 WADC-TR-55-480
Quantum Inc., Cheshire, Conn.
THE ULTRACENTRIFUGE AS AN INSTRUMENT FOR TESTING ADHESION. R. L. Patrick. Mar. 1956. 30p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: FACTORS AFFECTING THE ADHESION OF POLYMERS AND OTHER ADHERENDS TO VARIOUS MATERIALS. Contract AF33(616)-2465.

In order to investigate the fundamental aspects of adhesion it is necessary to eliminate the sandwich-type construction and utilize single interface samples. The most logical test method for a system of this nature is centrifugation. This report describes the development of the techniques of centrifugation to a point where the procedure is completely practical as a testing method for the examination of adhesion. Originally only metal substrates could be considered. The most recent modifications allow the use of many other substrates including glass. A complete description of the apparatus and modifications is included. (auth)

Refer also to abstract 4686.

WASTE DISPOSAL

4611
THE LONG-TERM ASPECT OF FISSION PRODUCT DISPOSAL. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 6, 270-6, 281(1955) Sept.

Based on the assumption that world nuclear fuel burnup will reach 1000 tons annually, methods of fission product disposal are reviewed. From the standpoint of safety and economy, quantitative separation of Sr and Cs followed by ocean or desert disposal of the remaining bulk seems most feasible. (D.E.B.)

MINERALOGY, METALLURGY, AND CERAMICS

4612 AERE-M/M-104
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A RECORDING CAMERA FOR METALLOGRAPHY WITH POLARISED LIGHT. B. R. Butcher and I. A. McDonald. Jan. 9, 1956. 7p.

The disadvantages of commercially available recording cameras when used for metallography are discussed, and it is shown how these can be overcome by adapting an R.A.F. type F24 camera for this work. Controls for the camera are described. (auth)

CERAMICS AND REFRACTORIES

4613 AWRE-H-15/53
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
THE DESIGN OF RESISTANCE HEATED HIGH TEMPERATURE HIGH VACUUM FURNACES. W. J. Kramers and F. Dennard. Nov. 1953. 15p.

Most of the furnaces suitable for heating objects of reasonable size to high temperatures under very high vacuum are at present operated by high-frequency induction. An experimental 10-kw vacuum furance with a resistance heating element is described. It can be assembled from commercially available equipment to operate directly from the a-c mains through a transformer. Promising operational results have been obtained and the design is suitable for the construction of larger furnaces on the

same principle. The cost is about half that of an induction furnace of similar size and performance. (auth)

4614 ISC-288(Suppl.)
Ames Lab., Ames, Iowa.
SINTERING MECHANISM AS APPLIED TO REFRACTORY OXIDES: A BIBLIOGRAPHY. SUPPLEMENT I, 1952–1955. D. R. Wilder. Jan. 15, 1956. 20p. Contract W-7405-eng-82. $0.20(OTS).

Reference and abstracts are given for much of the technical literature published during the years 1952 to 1955 pertaining to the sintering mechanism of refractory oxides. Some prior work which is concerned specifically with later publications has been included. Many of the abstracts have been taken directly from abstract journals or from author abstracts. The listing is alphabetically by authors. (auth)

4615 NACA-RM-E54B15
Lewis Flight Propulsion Lab., Cleveland.
EFFECTS OF SOME METAL ADDITIONS ON PROPERTIES OF MOLYBDENUM DISILICIDE. H. A. DeVincentis and W. E. Russell. Feb. 23, 1954. 22p.

The effect of the addition of approximately 6% Ni, Co, or Pt on some properties of $MoSi_2$ was investigated. These additions resulted in appreciably lowering the modulus-of-rupture strength from that of unalloyed $MoSi_2$. The thermal shock resistance was unimproved. The resistance to oxidation was decreased at higher temperatures. It is believed that above 2000 and 2400°F the Ni and Co alloys, respectively, formed low-melting intermetallics and possibly eutectics between these intermetallics. This resulted in considerable porosity. No uncombined metal could be detected in either hot-pressed or heat-treated material. In the Pt-containing bodies, uncombined metal was detected after hot pressing. The concentration of uncombined metal decreased as a result of heat treatment, and after treatment at the higher temperatures, could not be detected. (auth)

4616 NACA-TN-3309
Langley Aeronautical Lab., Langley Field, Va.
MECHANICAL PROPERTIES AT ROOM TEMPERATURE OF FOUR CERMETS OF TUNGSTEN CARBIDE WITH COBALT BINDER. Aldie E. Johnson, Jr. Aug. 31, 1954. 16p.

Room-temperature stress-strain curves are presented for compression tension, and shear loadings on four compositions of tungsten carbide with cobalt binder. Values of modulus of elasticity, modulus of ridigity, Poisson's ratio in the elastic region, ultimate strength, density, and hardness for the four materials are tabulated. (auth)

4617 NEPA-IC-51-3-21
Fairchild Engine and Airplane Corp. NEPA Div., Oak Ridge, Tenn.
FABRICATION AND PROPERTIES OF BERYLLIUM CARBIDE. John H. Coobs. Mar. 1951. 19p.

The various methods that have been employed in synthesizing beryllium carbide are critically reviewed. Since beryllium carbide is an uncommon material, its known physical and chemical properties are described. Because of its refractory nature and chemical instability in the presence of moisture, methods of fabricating beryllium carbide are definitely limited. Considerable success has, however, been achieved by hot pressing techniques, and by means of cold pressing followed by sintering under controlled conditions. Additions of graphite or of beryllium oxide to the carbide considerably facilitate fabrication. The physical properties of fabricated beryllium carbide-base bodies are discussed in detail, and the effects of graphite or beryllium oxide additives on the properties of the bodies are disclosed. (auth)

4618 WADC-TR-54-13(Pt.II)
American Electro Metal Corp., Yonkers, N. Y.
INVESTIGATION OF THE EFFECT OF RAW MATERIAL PRODUCTION VARIABLES ON THE PHYSICAL AND CHEMICAL PROPERTIES OF CARBIDES, NITRIDES AND BORIDES. Period covered: September 1953 to September 1954. H. Blumenthal. June 1955. 104p. Project title: CERAMICS AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AT 33(616)-89.

Particle size reduction of TiC by ball milling was found to be independent of the ball milling medium and a function only of ball milling time, size and kind of the ball mill, and ball-to-load ratio. Procedures were worked out for the determination of particle size distribution of a fine powder and for a flotation of such a material, which removed free carbon. Titanium carbide powders without binder addition were hot pressed to high densities and tested for electrical resistivity and corrosion resistance. It was found that a decrease in particle size, addition of up to 1% of free carbon, and acid leaching influenced densification beneficially. Leaching of a ball milled powder before hot pressing or higher densities of the hot pressed bars decreased electrical resistivity. The only corrosion product found by chemical analysis when TiC or 90/10 TiC/WC bars were exposed to air at 1000°C was TiO_2. Pieces of low densities were infiltrated with liquid cobalt and nickel and the factors governing infiltrability were studied. It was found that an oxide film surrounding the individual carbide particles was beneficial for good infiltration. Dense nickel bonded titanium carbide bars were produced by hot or cold pressing of ball milled powders followed by vacuum sintering. Various factors determining densification and transverse rupture strength, such as the presence of oxygen, free carbon, iron and other carbides as well as ball milling, pressing and sintering procedures were investigated. It was found that the relationship of these factors to the physical properties of final bars changed considerably with the origin of the titanium carbide used as starting material. A metallographic study was carried out in order to link physical properties to microstructure. It could be shown that microstructure, grain shape and grain growth were functions of three interrelated factors: production procedure of the titanium carbide, surface conditioning of the particles and impurities in the powder. An explanation of the "coring effect", long observed in cemented carbides, was given, based on the assumption of an oxide film surrounding the individual particles. (auth)

4619
NOTE ON FAILURE OF CERAMIC MATERIALS AT ELEVATED TEMPERATURES UNDER IMPACT LOADING. W. D. Kingery and J. Pappis (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram. Soc. 39, 64-6(1956) Feb.

The failure of Al_2O_3, MgO, Pyrex glass, soda lime–silica soft glass, and a triaxial semi-vitreous whiteware body under impact loading has been observed in some cases from room temperature to 1600°C. The pendulum energy required to fracture these materials remains constant or decreases with temperature over the temperature region of possible use. (auth)

CORROSION

4620 AD-64914
Ohio State Univ. Research Foundation, Columbus.
PROTECTION OF MOLYBDENUM AGAINST CORROSION AT HIGH TEMPERATURES. Quarterly Reports No. 10 and 11, [for] April 1, 1954–September 31, 1954. J. W.

Spretnak and Rudolph Speiser. Sept. 9, 1954. 22p. Contract N6onr-22528.

Spalling in cobalt molybdate on cooling is 'structural.' It is due to an exothermic phase change from the γ phase to the β phase on cooling. It appears extremely likely that spalling in nickel molybdate is almost exactly analogous to that in cobalt molybdate. Stabilization in the γ phase can be effected in nickel molybdate by manganese dioxide. In cobalt molybdate it can be effected by manganese dioxide and possibly by silica or zinc oxide, although it is not yet known whether these last two can produce a complete or permanent stabilization. The γ phase of cobalt molybdate is stabilized by alumina only as a step in the production of the spinel, $CoO \cdot Al_2O_3$. Further work on the alumina–cobalt molybdate system is therefore being deferred until there is time for an investigation on the possibility of protecting molybdenum with spinel coatings. Results on Mo–Ni–Mn and Mo–Co–Mn alloys show promise. A partially stabilized coating of nickel molybdate was formed on the alloy 68% Mo–22% Ni–10% Mn. An almost completely stabilized coating of cobalt molybdate was produced on the alloy 68% Mo–22% Co–10% Mn. Neither of these coatings was completely protective but it is believed that adjustments of the percentages of the constituents in these alloys will result in the formation of stabilized completely protective coatings. Oxidation of the alloy 63% Mo–25% Co–12% Si indicates that stabilized cobalt molybdate forms on the surface, but only temporarily. Zirconium molybdate and cupric molybdate have been prepared. Cupric molybdate has a melting point below 830°C, so further work on it will be dropped. (auth)

4621 AECU-3257

Case Inst. of Tech., Cleveland.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 12 [for] March 2, 1956 to June 2, 1956. C. A. Barrett, E. B. Evans, and W. M. Baldwin, Jr. June 11, 1956. 4p. Contract AT(11-1)-258. $1.80(ph OTS); $1.80(mf OTS).

Scaling of Zr at elevated temperatures in air was studied. Self-heating effects, H_2 pickup, and simulated scales were evaluated for their effect on the scaling. (F.S.)

4622 AERE-M/M-108

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REACTION OF BERYLLIUM WITH CARBON DIOXIDE IN THE TEMPERATURE RANGE 500-700°C. W. Munro and J. Williams. Feb. 1956. 16p.

The corrosion of dense Be in wet and dry CO_2 at atmospheric pressure has been investigated for the temperature range 500 to 700°C. At 500°C the corrosion rate in both wet and dry gas is negligible; at 600°C the corrosion product film is protective in the dry but not the wet gas; at 650 and 700°C the surface film is no longer protective even in the dry gas. Comparison of the weight gains in dry O_2 and dry CO_2 suggests that beryllium carbide formation may become significant at 650°C and make the oxide film non-protective. (auth)

4623 CF-52-9-59

Oak Ridge National Lab., Tenn.

SUBSURFACE VOID FORMATION IN METALS DURING HIGH TEMPERATURE CORROSION TESTS. Anton deS. Brasunas. Sept. 5, 1952. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Inconel and similar alloys were observed to be susceptible to subsurface void formation during processes involving chromium depletion of the surface zone by leaching with certain molten salts, high-temperature vacuum treatment, and high-temperature oxidation. (auth)

4624 ISC-653

Ames Lab., Ames, Iowa.

KINETICS OF THE REACTION BETWEEN THORIUM AND WATER VAPOR. B. E. Deal and Harry Svec. June 1955. 54p. Contract W-7405-eng-82. $0.35(OTS).

An examination of the reaction between Th and water vapor has been made between the temperatures of 200 to 600°C and at water vapor pressures of 40, 70, and 100 mm Hg. Analyses of the products have indicated that ThO_2 and H_2 are the main species formed during the reaction with thorium hydride as a possible side-reaction product. Two methods, gravimetric and manometric, were used successfully to determine the rates of reaction. During these rate studies three variables were examined: time, temperature and pressure. The reaction data were found to obey the logarithmic rate law $w = k \log(1 + 0.45t)$, where w = weight of water reacted per unit area of thorium surface, t = time and k is the rate constant. Three temperature regions have been examined in which different appearing oxides were observed: 200 to 275°, black; 300 to 450°, gray or white; and 450 to 550°, metallic. The rate constants were found to be first order in dependence on water vapor pressure. An average value of 6.44 ± 0.75 kcal/mole was calculated for the activation energy of the thorium–water vapor reactions. Several experiments were carried out in order to determine the reaction mechanism, and it has been postulated that inward diffusion of water molecules or a species thereof is the rate-determining step of the reaction. A value for the diffusion coefficient of water in ThO_2 was estimated to be approximately 10^{-7} cm^2/sec. Other experiments have shown H_2, produced by the reaction, to have diffused into the metal at the higher temperatures and lower pressures, thus causing erroneous results for rate constant values at those temperatures. (auth)

4625 ORNL-2054

Oak Ridge National Lab., Tenn.

OXIDATION CHARACTERISTICS OF THE ALKALI METALS. I. OXIDATION RATE OF SODIUM BETWEEN −79 AND 48°C. J. V. Cathcart, L. L. Hall, and G. P. Smith. June 14, 1956. 10p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

The oxidation rate of Na was measured at five temperatures: −79, −20, 25, 35, and 48°C. The reaction rate in dry O_2 was found to be small, and the oxide films were highly protective. A slight increase in the oxidation rate at 48°C occurred after 25,000 to 30,000 min of oxidation. No explanation has been found for this phenomenon. (auth)

4626 AEC-tr-2478

THE MECHANISM OF THE OXIDATION OF NICKEL AT LOW TEMPERATURES. K. Hauffe and B. Ilschner. Translated from Z. Elektrochem. 58, 382-7(1954). 19p.

Factors affecting nickel oxidation at low temperatures are discussed. General physical theories are evaluated and a tentative theory of the process is offered. (R.V.J.)

4627

CONDITIONS OF CAVITATION EROSION. K. K. Shal'nev. (Condensation of a report presented before the Symposium on Cavitation in Hydrodynamics, Sept. 1955, National Physical Laboratory, Teddington, England). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 1, 3-20(1956) Jan. (In Russian)

One of the most damaging effects of hydraulic equipment cavitation is the premature wear of the equipment caused by cavitation erosion. Many efforts and attempts to determine the mechanism of cavitation erosion phenomena did not produce any effective results. The absence of data of experimental observation of interaction of interaction between cavitation and cavitation-induced erosion makes the investigation of this problem difficult. Results are described of

experimental studies of the intensive action of cavitation erosion taking place behind a round profile of a model. (tr-auth)

Refer also to abstract 4540.

GEOLOGY AND MINERALOGY

4628 CEA-327

France. Commissariat à L'Énergie Atomique, Paris. PROSPECTION RADIOACTIVE DES MINERALS URANIFERES. (Radioactive Prospecting for Uraniferous Minerals). C. Lallemant. 1954. 6p.

The instruments used to prospect for uranium-bearing minerals are briefly described. (B.J.H.)

4629 CEA-380

France. Commissariat à L'Énergie Atomique, Paris. CONTRIBUTION A L'ÉTUDE DES PECHBLENDES FRANCAISES. (Contribution to the Study of French Pitchblendes). Jacques Geffroy and Jacqueline A. Sarcia. 1954. 176p.

The properties of pitchblendes are surveyed, and detailed descriptions are given of the French deposits. (B.J.H.)

4630 RME-2031(Pt. I)

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

EXPLORATION DIAMOND DRILLING IN THE BOULDER BATHOLITH, JEFFERSON AND SILVER BOW COUNTIES MONTANA. L. D. Jarrard and W. E. Mead. Mar. 1955. 13p. $0.15(OTS).

The Boulder batholith region is located in southwestern Montana (Figure 1). Uranium was first discovered in the area in June 1949 and since then many new occurrences have been recognized, although few are of commercial importance. During the summer of 1953, the Commission sponsored its first diamond drilling program in the batholith to explore at depth a number of interesting uranium showings. Operations commenced in July 1953 and ended in November 1953, with the completion of 60 holes totaling 9,807.5 feet. Radiometric logging of the drill holes was accomplished by means of a Geiger counter-type probe. Samples for chemical assay were selected after checking the core with a Geiger counter and correlation with the radiometric logging record. The exploration project did not disclose significant amounts of ore-grade material although encouraging indications were found at two different properties. (auth)

4631

BASTNAESITE, AN ACCESSORY MINERAL IN THE REDSTONE GRANITE FROM WESTERLY, RHODE ISLAND. William Lee Smith and Evelyn A. Cisney (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 41, 76-81 (1956) Jan.-Feb.

Bastnaesite, $CeFCO_3$, has been found in the Redstone granite of Martin (1925), which is one of the granites of the Sterling batholith near Westerly, R. I. It has not previously been recorded as an accessory mineral in granite. X-ray-diffraction powder patterns of the bastnaesite compare closely with a pattern obtained from bastnaesite from Mountain Pass, Calif. The three strongest diffraction lines are: 2.88, 3.56, and 1.895 A. A mean index of refraction measured on fine-grained material is 1.71. Spectrographic analysis showed a major amount of cerium and minor amounts of lanthanum, neodymium, calcium, and fluorine. (auth)

4632

ABERNATHYITE, A NEW URANIUM MINERAL OF THE METATORBERNITE GROUP. M. E. Thompson, Blanche Ingram, and E. B. Gross (U. S. Geological Survey, Grand Junction, Colo. and Washington, D. C. and U. S. Atomic Energy Commission, Grand Junction, Colo.). Am. Mineralogist 41, 82-90(1956) Jan.-Feb.

Abernathyite, a new uranium mineral from the Fuemrol No. 2 mine, Emery County, Utah, has the formula $K(UO_2)(AsO_4)\cdot 4H_2O$. The mineral occurs as transparent, yellow, fluorescent, thick tabular crystals belonging to the tetragonal system, ditetragonal-dipyramidal class (4/m 2/m 2/m). The space group is P4/nmm; $a_0 = 7.17 \pm 0.01$ A; $c_0 = 9.08 \pm 0.01$ A; a:c = 1:1.266; Z = 2. Optically, the mineral is uniaxial negative, $\epsilon = 1.570 \pm 0.003$, $\omega = 1.597 \pm 0.003$. The hardness is between 2 and 3. The calculated specific gravity is 3.74. The chemical analysis shows, in per cent: K_2O, 9.5; UO_3, 57.7; As_2O_5, 21.6; P_2O_5, 1.5; H_2O-4.6; H_2O+, 9.9; total, 104.8. Abernathyite is named for the finder, Jess Abernathy, operator of the Fuemrol mine. (auth)

4633

STUDIES OF URANIUM MINERALS. XIX. RUTHERFORDINE, DIDERICHITE, AND CLARKEITE. Clifford Frondel and Robert Meyrowitz (Harvard Univ., Cambridge, Mass. and U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 41, 127-33(1956) Jan.-Feb.

Rutherfordine, diderichite, and a synthetic uranyl carbonate obtained by heating UO_3 in H_2O under 15,000 psi CO_2 at 300°C. afforded indentical x-ray powder patterns, and on analysis each yielded the formula $(UO_2)(CO_3)$. The name rutherfordine has priority. Two new localities are recorded for rutherfordine at Beryl Mountain, N. H., and Newry, Maine, where it occurs as a weathering product of uraninite in pegmatite. Rutherfordine occurs as crusts and aggregates of orthorhombic (?) fibers; biaxial positive, with nX = 1.720−1.723, nY = 1.728−1.730, nZ = 1.755−1.760; Y along the fiber length. Clarkeite is described from its second known locality, the Ajmer district, Rajputana, India, where it occurs as microcrystalline, chocolate-brown alteration product of uraninite in pegmatite. Analysis yielded the formula (Na, Ca, Pb, Th, $H_2O)_2U_2(O, H_2O)_7$; isostructural with $Na_2U_2O_7$ and CaU_2O_7. Specific gravity is 6.29, mean index of refraction 1.94−1.97. (auth)

4634

AGE DETERMINATION OF ZIRCON CRYSTALS FROM CEYLON. David Gottfried, F. E. Senftle, and C. L. Waring (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 41, 157-61(1956) Jan.-Feb.

4635

PHOTOGEOLOGIC MAP OF THE ELK RIDGE-8 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-126. C. F. Miller. Washington, U. S. Geological Survey, 1956. $0.50.

4636

URANIUM−LEAD METHOD OF AGE DETERMINATION. PART I. LAKE ATHABASCA PROBLEM. Walter R. Eckelmann and J. Laurence Kulp. Bull. Geol. Soc. Amer. 67, 35-54(1956) Jan.

A suite of samples of pitchblende, clausthalite, and galena from various mines in the Lake Athabasca uranium province has been subjected to isotopic and chemical analyses as well as radon-leakage measurements in order to obtain apparent ages from the isotopic ratios Pb^{206}/U^{238}, Pb^{207}/U^{235}, and Pb^{207}/Pb^{206}. Pb^{210}/Pb^{206} measurements were made to check equilibrium in the decay series. The apparent isotopic ages range from 220 to 1860 m.y. Alteration effects which might explain these anomalies are considered. Uranium leaching and radon leakage are inadequate to explain these anomalies. The diverse ages can be calculated on the hypothesis of a single period of pitchblende deposition at 1.90 ± 0.04 b.y. ago followed by two periods of

exsolution of lead at about 1.2 and 0.15 b.y. This is consistent with the 207/206 ratio of the radiogenic lead in the clausthalite and galena which apparently formed at the times of recrystallization. However, the existing data do not preclude more than two periods of lead exsolution. An alternative hypothesis involving successive epochs of pitchblende deposition is more complex geologically and, without contemporaneous lead exsolution, cannot account for the observed isotopic relations. The recrystallization presumably requires only the elevation of the regional temperature to 150 to 300°C in the presence of water. The variable fractions of lead removed during the periods of recrystallization can be ascribed to variations in temperature and water content throughout the district. It is quite certain that the initial uranium deposition occurred about 1.9 b.y. ago; there have been at least two periods of lead exsolution; one period of lead exsolution must have occurred subsequent to 0.22 b.y. ago; another period of lead exsolution probably occurred about 1.2 b.y. ago; alteration of subsurface pitchblende has been negligible during the last million years. (auth)

4637

RADIOMETRIC SURVEYING WITH A CAR-BORNE COUNTER. S. H. U. Bowie, F. H. Hale, D. Ostle, and K. E. Beer. Bull. Geol. Survey Gt. Brit., No. 10, 1-23(1955).

Robust Geiger-Müller and scintillation counters with cold cathode valve circuits, specially designed for car-borne use, have been employed by the Atomic Energy Division of the Geological Survey since 1950. The equipment, which is particularly suited for installation in a Land-Rover, is operated from the car's battery and is provided with audible alarm, ratemeter and continuous recording mechanisms. Records obtained with the Geiger-Müller and scintillation detectors indicate that although the scintillometer has a performance factor about twice that of the Geiger counter, the latter instrument is the more stable and has a sensitivity which is adequate for prospecting purposes. The effects of gamma-ray absorption, solid geometry, the time constant of the instrument, speed of traverse, road metal, cosmic rays and weathering conditions are discussed, and both theoretical and empirical data are presented to show the limitations as well as the usefulness of the equipment. A brief account is given of field surveys in West Africa, Southern Africa, and Norway, illustrated with reproductions of sections from the recorder traces. The data on the ratioactivity of various bedrock formations derived from the traces recorded in routine field traversing agree well with laboratory determinations carried out on grab samples of the same rock. (auth)

4638

RADIOACTIVITY STUDIES OF SOME BRITISH SEDIMENTARY ROCKS. D. R. A. Ponsford. Bull. Geol Survey Gt. Brit., No. 10, 24-44(1955).

An account is given of some of the more radioactive rocks present in the British sedimentary sequence. In most cases the radioactivity is due dominantly to the content of uranium, but in no instance is the concentration sufficient to give the deposits an economic value. The highest uranium contents are to be found in certain black shales in Upper Cambrian, Upper Ordovician, and Upper Carboniferous rocks; in black nodules present in New Red Sandstone strata; and in phosphatic beds of various ages. Except for some phosphorites of Lower Cretaceous and Tertiary age no Post-Triassic rocks have yet been found to possess a noteworthy radioactivity. (auth)

4639

THUCHOLITE AND HISINGERITE-PITCHBLENDE COMPLEXES FROM NICHOLSON MINE, SASKATCHEWAN, CANADA. S. H. U. Bowie. Bull. Geol. Survey Gt. Brit., No. 10, 45-57(1955).

Material resembling thucholite, from the Nicholson Mine, Saskatchewan, Canada, has been found on detailed study to consist of two types of fine-grained complex: in one pitchblende is intergrown with hydrocarbon, and in the other it is closely associated with hisingerite. The paragenesis of the ores is outlined and new data are presented on the properties of hisingerite. Canbyite is discredited as a valid species. It is suggested that the term 'thucholite' be applied to an assemblage consisting essentially of a radioactive mineral and a hydrocarbon or hydrocarbons. (auth)

4640

THE AGE OF THE MINERALIZATION OF THE WITWATERSRAND. J. E. T. Horne and C. F. Davidson. Bull Geol. Survey Gt. Brit., No. 10, 58-73(1955).

An attempt has been made to arrive at the age of mineralization of the Witwatersrand by the isotropic analysis of lead, extracted from samples of uraninite and galena from the banket reefs. The investigation has been executed with the assistance of various research organizations in Great Britain, South Africa, U.S.A., and Canada. The galena associated with the uraninite is of two types: (i) minute blebs disseminated throughout the uraninite composed of lead which is shown to be wholly or mainly radiogenic, and (ii) free galena mechanically separated from the uraninite composed of lead of which some 42 per cent is radiogenic. The Pb^{207}/Pb^{206} ratio in this radiogenic component corresponds to a mean age of generation of 1820–1845 million years, the lead having been generated throughout an indefinite period both prior to and after this date. The apparent ages of the uraninite derived from the ratios Pb^{206}/U, Pb^{207}/U, and Pb^{207}/Pb^{206} are respectively 1328–1352, 1593–1652, and 1965–2070 million years. The agreement is poor, and investigation has therefore been made of the reasons for these widely divergent results. The three most likely possibilities are: (i) loss of lead by large-scale radon diffusion; (ii) introduction of initial radiogenic lead; (iii) re-working of the reefs to give more than one generation of uraninite. There is experimental evidence to show that the rate of radon diffusion is not high, and the postulated initial introduction of radiogenic lead is apparently invalidated by the differences in isotopic composition between the two types of galena present. That re-working of within the reefs themselves is the most probable explanation is shown by a chemical study of a 'young' uraninite from West Rand Consolidated Mines, selected with careful mineragraphic control, the uncorrected age of this mineral being only 159 million years. The hypothesis of re-working accounts satisfactorily for the abnormal isotopic composition of the free galena. The results of the investigation fail to show conclusively whether the initial mineralization was of a syngenetic or epigenetic character. The minimum age of the initial mineralization is approximately 2000 million years. (auth)

4641

ON THE IMPERSISTENCE OF URANINITE AS A DETRITAL MINERAL. C. F. Davidson and M. E. Cosgrove. Bull. Geol. Survey Gt. Brit., No. 10, 74-89(1955).

At Carbis Bay on the north coast of Cornwall an old mine dump with pitchblende (uraninite) in its debris abuts on the shore, and feeds a small pebble bed along highwater mark. A radiometric and mineralogical examination has been made to determine the extent to which pitchblende persists in the pebble bed and also in the sands which form the greater part of the beach. Rounded fragments of weathered pitchblende are readily found among the gravel; but as the pebbles become comminuted to sand the pitchblende does not survive, disappearing by chemical and physical weathering. It is concluded that alluvial pitchblende or uraninite has only a short life, and that hypotheses on the placer origin of

pitchblende-uraninite deposits in the sediments of the Witwatersrand and of Colorado-Utah cannot be maintained. (auth)

METALS AND METALLURGY

4642 AD-55832
Rensselaer Polytechnic Inst., Troy, N. Y. Powder Metallurgy Lab.
PRODUCTION OF POROUS METAL COMPACTS. Final Report. F. V. Lenel, R. L. Reddy, and O. W. Reen. Nov. 1954. 238p. Contracts NOas-11022, NOas-52-128c, and NOas-53-038c.

Experiments were made to produce porous materials by loose powder sintering. Iron powder electroplated with Cu had high permeability of three grades of pressed and sintered austenitic stainless steel. Compacts made from coarse-mesh powder had a higher permeability but lower strength. Tests of Timkin alloy sintered at 2500°F obtained reasonable strength. An impregnation-treatment method was devised to prevent permeability loss during machining. (F.S.)

4643 AD-56362
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
DEFORMATION OF MATERIALS AT ELEVATED TEMPERATURES. Final Report [for] April 1951 through January 31, 1955. Arup Chaudhuri, Gordon Gemmell, Hans Brunner, and Nicholas J. Grant. Jan. 1955. 52p. Contract AF33(616)-23281.

Research was conducted on the deformation mechanisms prevailing in high-purity Al and its alloys during creep in the range of 200 to 1100°F. Current research is reported on the following: (1) role of solid solution hardening in Al on the creep behavior at elevated temperatures; (2) creep deformation of Mg at elevated temperatures; (3) strain mapping in polycrystalline high-purity Al during creep at elevated temperatures; (4) oxide cracking during creep of pure Al as a measure of strain; and (5) effect of prior substructure on the creep strength of high-purity Al. (ASTIA Abst.)

4644 AD-67971
Massachusetts Inst. of Tech., Cambridge. Dept. of Michanical Engineering.
MACHINING TITANIUM. M. C. Shaw, S. O. Dirke, P. A. Smith, N. H. Cook, E. G. Loewen, and C. T. Yang. June 1954. 100p. Contract AF33(600)-22674.

A general picture of the single-point machining characteristics of Ti alloys for practical engineers in the workshop and results and discussion of interest to those engaged in research is presented. A comparison of the physical properties of Ti, steel, stainless steel, and Al is made. (F.S.)

4645 AD-70174
Ohio State Univ. Research Foundation, Columbus.
FATIGUE TESTS OF TITANIUM ALLOY AND SAE 4340 STEEL SPECIMENS. Semi-Annual Report [for] Period January 1, through April 30, 1955. (Report No. 31). W. L. Starkey. May 3, 1955. 55p. Projects AF-5-(3-3346) and RF-518. Contract AF33(616)-209.

A new specimen-measuring fixture was used to improve the ease and accuracy of measuring the fretting-fatigue specimens. This instrument is a comparator which is calibrated with a master gage before starting each series of specimen measurements. A cam lift is used to lift the probe after calibration and setting. The instrument is capable of reproducing measurements to within about ±0.00002 inch. The accuracy of measurement is of the order of ±0.00005 inch. The size of the fretted area was measured on Ti alloy and steel specimens, and was expressed as a percentage of the total area available for fretting. The shape of the fretted area was noted for each specimen. Shape was defined to include both general outline and the distribution of fretted spots on the specimen. The various shapes of the fretted areas were classified into groups and each group was arbitrarily assigned a class number. The class of fretting and percentage of fretted area were each plotted against the Prot failure stress. These plots did not in general show a correlation. Prot failure stress appeared to increase with increasing percentage of fretted area at one set of conditions. No correlation appeared to exist between atmospheric conditions and failure stress for these tests. (ASTIA abst.)

4646 AECU-3252
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
RESEARCH ON URANIUM-BASE ALLOYS. Letter Report No. 21. R. J. Van Thyne. June 13, 1955. 9p. Project No. B-049. For Westinghouse Electric Corp. Atomic Power Div., Subcontract 73-(14-309), Task 6. $1.80 (ph OTS); $1.80(mf OTS).

Samples of the uranium-base alloys containing 10 and 20 wt. % niobium were solution-treated at 1050°C and isothermally transformed at temperatures between 300 and 600°C. The gamma phase decomposes monotectoidally (or eutectoidally) to a product of alpha and gamma phase of high niobium content. Results of 100-hour annealing are not available yet, but the kinetics data for these compositions are presented. (F.S.)

4647 BM-RI-5175
Bureau of Mines.
EXPERIMENT PRODUCTION OF HIGH-PURITY COBALT. K. K. Kershner, F. W. Hoertel, and J. C. Stahl. Jan. 1956. 13p.

A detailed procedure which is of practical significance to the production of high-purity Co was developed for purifying Co solutions and for electrolytic deposition of the metal. Methods for analyzing purified products are listed. (J.E.D.)

4648 CAL-KA-797-M-11
Cornell Aeronautical Lab., Inc., Buffalo.
DEVELOPMENT OF SUBSTITUTE ALLOYS FOR HIGH TEMPERATURE USE. Bimonthly Progress Report. J. Salvaggi and G. J. Guarnieri. June 30, 1954. 15p. Contract NOa(s)-52-368-c. (AD-46654)

The creep-rupture properties of three 30-lb heats, solution treated at 2300°F, have been determined for a test temperature of 1350°F. Compositions of these three alloys were based on the three most promising steels developed during the first year's work. Addition of tungsten to a 17 Cr–15 Ni–2.5 Mo–0.15 C–0.15 B–0.80 Ti stainless steel was found to stabilize the microstructure, resulting in a combination of strength and ductility not previously achieved. The 1500°F, 100-hr rupture strength of 18,500 psi obtained for this series was accompanied by a rupture ductility of 8%. The presence of Zr, in amounts up to approximately 0.54%, had little effect on the strength properties of a 17 Cr–15 Ni–2.5 Mo 0.15 C stainless steel with Ti alone or Ti and B combined. (ASTIA abst.)

4649 CAL-KB-868-M-5
Cornell Aeronautical Lab., Inc., Buffalo.
EVALUATION OF TITANIUM AIRCRAFT PARTS AND SEMI-FINISHED PRODUCTS. Bimonthly Progress Report No. 5, [For] October 16, 1953 to December 15, 1953. L. W. Smith and F. J. Gillig. 77p. Contract AF33(616)-471. (AD-33366)

Responses were received from 14 of the aircraft companies surveyed with questionnaires concerning the 3

problem areas: mechanical property variation in unalloyed and alloyed Ti sheet, fatigue of forged Ti, and stress relief procedures. The replies are listed alphabetically according to company under the 3 headings, and the supporting data are appended. All the companies reported a large spread in the mechanical properties of commercially pure and alloy Ti from heat to heat and between different sheets in the same heat. Designers must allow for this variation by using the lowest strength value in the strength scatter band. The variation between the yield and ultimate strengths was important in cold-forming operations, but not in hot-forming ones. Nearly all companies reported that Ti forgings were unsatisfactory from the fatigue standpoint. Temperatures for proper stress relief were reported to range from a mild stress relief at 550°F to a full anneal at 1300°F. (ASTIA abst.)

4650 CAL-KB-914-M-1

Cornell Aeronautical Lab., Inc., Buffalo.

RELAXATION BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report. F. J. Vawter and G. J. Guarnieri. July 1, 1954. 8p. Contract AF33(616)-2340. (AD-44927)

Construction is in progress on 6 relaxation-testing machines which will be equipped with furnaces and temperature-control instruments for elevated-temperature testing; 2 other units will be used only for constant room-temperature testing. Relaxation testing will involve load application on the specimen through a compressed coiled spring, detection of the resulting strain by a cantilever strain-gage extensometer system, conversion of the strain to an electrical signal, and transmission of the signal to a controller-recorder. Relaxation tests are planned on RC-70 (A-70) commercially pure Ti, A-110AT all-α alloy, and RC-130-B (C-130AM) $\alpha + \beta$ alloy at several initial stresses in the range between 85° and 1000°F. Creep data also will be obtained on the α+ alloy for correlation with the relaxation data. (ASTIA abst.)

4651 ERI-2076-6-P

Michigan. Univ., Ann Arbor. Engineering Research Inst.

INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 9 covering the period from June 1, 1955 to August 31, 1955. J. V. Gluck and J. W. Freeman. Aug. 31, 1955. 18p. Contract AF33(616)-244, Supplemental Agreement S9 (55-1113).

Research carried out on the elevated temperature properties of titanium alloys is dicsussed. This program is principally concerned with effects of contaminants on properties and the relative stability of various structures. Vacuum annealing was carried out on a number of materials in order to produce material of low hydrogen content. In addition, hydrogenation tests were carried out on Ti 75A and Ti−10% Mo alloys to produce desired higher hydrogen contents. The study of the effects of cold working on the 1000°F properties of a Ti−6%Al−½%Si alloy was brought almost to completion. The study of the effect on room temperature tensile properties of exposure of Ti 150A to creep test conditions was started. The initial tests covered material of low hydrogen content and the effects of stressed exposure at 600 and 1000°F. (auth)

4652 ISC-666

Ames Lab., Ames, Iowa.

MEASUREMENT OF SPECIFIC HEATS BY A PULSE METHOD. Richard C. Strittmater and Gordon C. Danielson. Aug. 1, 1955. 27p. Contract W-7405-eng-82. $0.25(OTS).

A pulse-heating method for measuring the specific heat of metals at all temperatures has been developed. The apparatus will deliver a current pulse of sufficient magnitude to heat a fine wire sample to its melting temperature in a short time, for example 0.1 second. Under these conditions, the energy losses from the wire are negligibly small compared with the energy input. By recording simultaneously with a dual beam cathode ray oscilloscope the current through and the potential across a sample, one can determine at any instant the power input and the resistance of the wire. From the resistance of the wire and the results of a preliminary experiment on the resistance-temperature relationship the temperature can be found. By a single heating pulse a plot of the temperature as a function of time can be made. Since the power input and the mass of the sample are known, the specific heat, at any temperature within the range of the test, can be calculated. Preliminary results are given for Pt and Ni over the temperature range 25°C to 500°C. (auth)

4653 KAPL-852

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL ELECTROMOTIVE FORCE OF URANIUM, TITANIUM, AND ZIRCONIUM. L. L. Wyman and J. F. Bradley. Dec. 19, 1952. Decl. Nov. 22, 1955. 31p. Contract W-31-109-Eng-52. $0.20(OTS).

The thermal electromotive force of U−Pt, Ti−Pt and Zr−Pt thermocouples as a function of temperature has been determined with an automatic recording device. The effect of variables such as cold working, annealing, and thermal cycling upon the electromotive force of a U−Pt thermocouple was also observed. (auth)

4654 MAB-87-M

National Research Council. Materials Advisory Board.

STABILIZED AUSTENITIC STAINLESS STEELS. Dec. 30, 1954. 24p. Contract DA-49-025-sc-83. (AD-49668).

The principal uses were reviewed of stabilized austenitic stainless steels for military and other applications. Findings will be used to establish the over-all need for Nb-containing austenitic stainless steel and for determining the need for critical and strategic materials required in the manufacture of these steels. For service up to 800°F in applications which may be subject to short-time exposure in the 800° to 1650°F range, Nb-stabilized stainless steel may be replaced by low-carbon (0.03% C maximum) stainless steel. For service in the 800° to 1650°F range, Nb-containing austenitic stainless steel may frequently be replaced by Ti-stabilized stainless steel. As welding of Nb-stabilized and Ti-stabilized stainless steels requires the use of Nb-stabilized stainless steel electrodes; low-carbon (0.03% C maximum) stainless steel is best welded with the Nb-stabilized type of steel. In both the aircraft industry and the chemical process industry, a few uses exist in which Nb-stabilized stainless steel appears to be the most satisfactory material. These do not require substantial tonnage. (ASTIA abst.)

4655 NAA-AL-2064-1

North American Aviation, Inc., Downey, Calif.

STATUS OF TITANIUM ALLOY DEVELOPMENT PROGRAM. Progress Report No. 2. C. W. Handova and J. T. Milek. Nov. 9, 1954. 10p. Contract W-33-(038)-ac-14191. (AD-49812).

Failure in brake press forming necessitated evaluation of vacuum furnace degassing as a method of obtaining increased ductility and formability in Al−Mn−Ti alloy. Six hours degassing at 1300°F with furnace cooling increased ductility, thus material from the same heat and sheet was bent on a 2t (two times the thickness of the material) bend radius. (F.S.)

4656 NAA-AL-2064-6

North American Aviation, Inc., Downey, Calif.

STATUS OF TITANIUM ALLOY DEVELOPMENT PRO-

GRAM. Progress Report No. 7. Feb. 4, 1955. 23p. Contract AF33-600-28469. (AD-57142).

Mechanical properties of Ti–6Al–4V are reported in the longitudinal and transverse directions for parent metal, fusion welded and spotwelded material. The mechanical properties of Ti–6Al–4V at 700°F were far above the general requirements of 80,000 psi ultimate tensile strength and 64,000 psi compression yield strength. All results were obtained on material which had a vacuum degassing heat treatment at 1300°F. Preliminary spot-welding data looks encouraging. Fusion welds also indicate good tensile strength properties and fair bendability characteristics. Circular patch weld restraint tests were made but not evaluated to date since a 30 day period is required to test locked-in stresses. Standardized formability test procedures are being evolved and some parts have been formed with standardized test dies. Preliminary tests indicate that Ti-6Al-4V is less formable than RC-A110AT. Some progress has been made to resistance braze 17-7 PH stainless steel to titanium alloy RC-A110AT. (auth)

4657 NACA-TN-3315

Langley Aeronautical Lab., Langley Field, Va.

TENSILE AND COMPRESSIVE STRESS-STRAIN PROPERTIES OF SOME HIGH-STRENGTH SHEET ALLOYS AT ELEVATED TEMPERATURES. Philip J. Hughes, John E. Inge, and Stanley B. Prosser. Nov. 1954. 32p.

Results of tensile and compressive stress-strain tests at temperatures up to 1,200°F are presented for SAE 4340, Hy-Tuf, Stainless W, and Inconel X sheet materials which had ultimate tensile strengths at room temperature in the 170 to 220 ksi range. Representative tensile and compressive stress-strain curves are given for each material at the test temperatures. Secant and tangent moduli, obtained from the compressive data, are included. (NACA Abst.)

4658 NACA-TN-3596

Langley Aeronautical Lab., Langley Field, Va.

ON THE PERMEABILITY OF POROUS MATERIALS. E. Carson Yates, Jr. [Oct. 7, 1955]. 32p.

The effects of porous-material permeability characteristics of absolute pressure level (and associated scale effects), choking of the flow, bending the material, and other factors have been investigated. Samples of 30- by 250-mesh rolled Monel metal cloth and $\frac{1}{16}$-inch-thick sintered bronze were calibrated with constant upstream pressures of 1 atmosphere and $2\frac{1}{3}$ atmospheres (varying down-stream pressure) and with constant downstream pressure of 1 atmosphere (varying upstream pressure). Experiments showed permeability to be appreciably affected by absolute pressure level, flow choking, and thickness of the material. Moderate bending of the material caused no noticeable change in the permeability. Simple calculation and correlation procedures were developed for determining permeability with reasonable accuracy when experimental data are limited. (auth)

4659 NACA-TN-3681

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION OF PLASTIC BEHAVIOR OF BINARY ALUMINUM ALLOYS BY INTERNAL-FRICTION METHODS. R. E. Maringer, L. L. Marsh, and G. K. Manning. July 31, 1955. 44p.

Internal-friction tests have shown that nominal additions of 0.1, 1.0, and 5.0 wt.% Cu and Mg to Al have significant effects on dumping behavior. Small additions of Cu to Al raised the internal friction and lowered the shear modulus above 200°C. Large additions of Cu and of Mg raised the shear modulus and lowered the damping. An "anomalous" internal-friction peak at about 125°C has been observed in Al containing 1.00% Cu and is believed to result from the interaction of dislocations and impurity particles. Other small peaks which were observed in high Cu and Mg alloys appear to result from the stress-induced diffusion of impurity atoms. Aging is shown to decrease the internal friction in most cases, probably because of the segregation of foreign atoms at grain boundaries and/or subboundaries. The internal friction during plastic deformation was sensitive to strain rate, amount of strain, alloy content, heat treatment, temperature, and the frequency at which the measurements are made. The internal friction decreased with increasing temperature for alloys containing 0.08% Cu and 0.09% Mg but increased with increasing temperature for richer alloys. (auth)

4660 NACA-TN-3685

Battelle Memorial Inst., Columbus, Ohio.

FATIGUE CRACK PROPAGATION IN SEVERELY NOTCHED BARS. W. S. Hyler, E. D. Abraham, and H. J. Grover. July 29, 1955. 31p.

Fatigue tests were made in rotating bending on severely notched bars machined from 2024-T4 aluminum-alloy extruded round rods. Two sizes of specimens were studied, $\frac{1}{4}$-inch-diameter and 2-inch-diameter specimens. The smaller specimens were notched with a V-groove and had notch severities K_t of 5.2. The larger specimens also contained V-grooves with notch severities $K_t = 5.2$ and 13.9. It was found that, unlike behavior sometimes observed for unnotched and mildly notched bars, fatigue cracks initiated early in the lifetime of the severely notched specimens. In the case of the $\frac{1}{4}$-inch-diameter bars, initiation occurred (at a test stress of 22.5 ksi) in less than 0.25 percent of the average lifetime of the specimen. It appeared that cracks in large-diameter specimens had a period of rapid crack growth followed by a marked tapering off in rate of crack propagation. This behavior may have been associated with compressive residual stresses, which were demonstrated qualitatively to be present. Other factors also may have influenced this behavior. (auth)

4661 NRL-4683

Naval Research Lab., Washington, D. C.

THE EFFECT OF GASES IN STEEL. J. A. Rinebolt and R. H. Raring. Dec. 7, 1955. 20p.

AISI 4340 steels melted in air, in vacuum, and in an argon atmosphere were heat-treated to strength levels ranging from 150,000 to 290,000 psi and compared with respect to tensile properties, Charpy V–notch properties, susceptibility to static fatigue failure in a notch tensile test, and susceptibility to embrittlement resulting from cathodic charging and cadmium plating. No significant benefits were conferred by vacuum melting or by melting in argon. Air-melted AISI 4340 steels with additions of 0.15% arsenic were not significantly more susceptible to hydrogen embrittlement than were steels without additions of arsenic. (auth)

4662 NYO-7493

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATION OF GRAIN REFINEMENT IN BERYLLIUM INGOTS RESULTING FROM THE APPLICATION OF ELASTIC VIBRATORY ENERGY DURING COOLING AND SOLIDIFICATION. Progress Report No. 2 Covering Period from September 1 to October 31, 1955. 11p. Contract AT(30-1)-1836. $3.30(ph OTS); $2.40(mf OTS).

Review of the literature indicated that grain refinement in some metals may be achieved by suitably controlling the cooling and solidification process and/or by the addition of appropriate agents to the melt. Grain refinement by ultrasonic means is achieved only when the elastic energy is introduced at some temperature above the liquidus; the effectiveness of the grain refinement apparently depends on the product of the ultrasonic frequency and the amplitude of vibration. The design of the experimental furnace

was finalized, detailed, and released for fabrication. A study of the pertinent physical constants, such as resistivity, specific heat, heat conductivity, and latent heat, revealed that copper, iron, and nickel bracket the heat requirements of beryllium and therefore appear suitable as simulants for checking furnace requirements and the control of the migration of the solid-liquid interface. Since the ultrasonic coupler must be made of a material which will not readily dissolve in molten beryllium and yet which can be easily wetted with the beryllium, Nuclear Metals is making exploratory solubility tests with tantalum, molybdenum, and tungsten as candidate coupler materials. (auth)

4663 ORNL-1468

Oak Ridge National Lab., Tenn.

THE ELECTROLYTIC PREPARATION OF SMALL QUANTITIES OF ALKALI METALS. P. S. Baker, G. F. Wells, and W. R. Rathkamp. Jan. 2, 1953. Decl. Nov. 14, 1955. 15p. Contract W-7405-eng-26. $0.20(OTS).

In the program of separating the isotopes of the alkali metals, it seemed desirable to develop a method for obtaining the metals in small quantities from their isotopic salts. The only methods available either involved large quantities of material or produced only thin layers of metal, neither of which was satisfactory for the purpose. Several possibilities were considered, including chemical reduction as well as electrolysis of both aqueous and nonaqueous solutions of salts. The electrolysis of the fused chloride was finally adopted as most suitable. Using readily available materials of construction, a cell was developed which permits the formation of more than one gram of Li metal from as little as 10 cc (20 g) of the fused salt. The cell may also be used for semi-continuous production of larger amounts of metal. Total recovery of metal and salt from the cell is above 95% of the material charged to the cell. A technique for removing the molten metal with a stainless steel pipet and a method for storing it in glass for extended periods of time were also worked out. (auth)

4664 OSR-TR-56-22

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF A FAMILY OF LAVES-TYPE INTERMEDIATE PHASES. Technical Report No. 1. Rodney P. Elliott. Apr. 25, 1956. 33p. Project B 079. Contract AF18(600)-1399. (AD-88033).

The periodic variation of the crystal structure type of the Laves phases of Ti, Zr, Hf, Nb, and Ta may be correlated with electronic variations. Allotropy is the exception rather than the rule and occurs only for those binary phases that have electron:atom ratios near a critical value. Consideration of ternary Laves-type phases indicates that there are two Brillouin Zone overlaps governing the structure type. On the assumption that the valency of Ti is near 4, it has been possible to calculate the valencies of the first transition elements as follows: Ti, 3.92; Zr, 3.25; V, 2.19; Cr, 1.69; Mn, 1.35; Fe, 0.92; and Co, 0.72. Valencies of 0.25 and 0.00 for Ni and Cu, respectively, are consistent with the foregoing valencies. (auth)

4665 R55A0213

General Electric Co., Schenectady, N. Y.

FACTORY EXPERIMENTAL METHODS DEVELOPMENT ON TITANIUM ALLOY TI-150A. G. R. Cascini. May 1, 1955. 18p. DA Project 502-08-022. Contract DA-30-115-ORD-1. (AD-62459).

A study is reported on the development of methods for the following machining phases for Ti-150A: sawing, shaping, turning, milling, drilling, and tapping. It was found necessary to apply Thread-Cut no. 99 in a steady flow directed at the tool cutting edge as a lubricant. (F.S.)

4666 SEP-90

Sylvania Electric Products Inc. Metallurgical Lab., Bayside, N. Y.

DILATOMETRIC STUDIES OF ZIRCONIUM AND ZIRCONIUM–TIN ALLOYS BETWEEN 25° AND 1100°C. R. W. Balluffi, R. Resnick, and A. J. Timper. June 9, 1952. Decl. Nov. 18, 1955. 13p. Contract AT-1-30-GEN-366. $0.15(OTS).

The temperature and temperature range of the alpha-to-beta transformation, as revealed by dilation measurements, are in qualitative agreement with the present noncompleted phase diagram of the Armour Research Foundation. A volume decrease occurred in all alloys as a result of the alpha-to-beta transformation in contrast to the expansion predicted by available x-ray data. The thermal expansion of Zr–Sn alloys containing up to 7% Sn is given by the equation $L_T = L_0 (1 + 5.7 \times 10^{-6} T + 1.0 \times 10^{-9} T^2)$ where T is in degrees centigrade over the temperature range between room temperature and the $\alpha \rightarrow \beta$ transformation. This expression refers to polycrystalline alloys with random grain orientation. These dilation measurements were not sufficiently accurate to distinguish any systematic variation of the expansion coefficients with Sn content. (auth)

4667 TML-42(Vols. 1 and 2)

Battelle Memorial Inst., Titanium Metallurgical Lab., Columbus, Ohio.

FORMING OF TITANIUM AND TITANIUM ALLOYS. VOLUME 1. PART I. GENERAL CONSIDERATIONS IN THE FORMING OF TITANIUM SHEET. PART II. SPECIFIC METHODS OF FORMING TITANIUM SHEET. PART III. SOME FORMING PROBLEMS SUGGESTED BY THE AIRFRAME INDUSTRY. VOLUME 2. APPENDIX A. TYPICAL PROCESS SPECIFICATIONS APPLICABLE TO TITANIUM AND ITS ALLOYS. APPENDIX B. FORMING TITANIUM SHEET—QUESTIONNAIRES. APPENDIX C. LIST OF GOVERNMENT RESEARCH PROJECTS RELATED TO THE FORMING OF TITANIUM AND ITS ALLOYS. W. P. Achbach. May 18, 1956. (Vol. 1, 253p. and Vol. 2, 174p.). Contract AF18(600)-1375.

These two volumes were issued separately, but are cataloged as a unit.

A survey of the airframe industry was made to determine the state of art of forming titanium sheet. Thirteen major forming methods evolved from information obtained by personal visit and discussion and through answers to questionnaires submitted to the airframe industry. Approximately 20 airframe producers were visited and their forming methods observed and discussed. In addition, some 300 questionnaries, designed on the basis of the information obtained during visits to airframe manufacturers, were submitted to companies directly engaged in forming titanium sheet metal shapes. Also, the literature collected by the Titanium Metallurgical Laboratory information center was reviewed and extracted. (auth)

4668 TML-43

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

AN EVALUATION OF COMPRESSION-TESTING TECHNIQUES FOR DETERMINING ELEVATED-TEMPERATURE PROPERTIES OF TITANIUM SHEET. Walter S. Hyler. June 8, 1956. 69p. Contract AF 18(600)-1375.

An evaluation of elevated-temperature compression-testing techniques currently in use for obtaining design data on titanium sheet is presented. Data and techniques were analyzed to determine suitable equipment and experimental technique for obtaining reliable compressive properties. Recommendations are made concerning certain features of a compression-test procedure and equipment associated with such tests. The major un-

answered question in this regard is the design of a suitable specimen-support system. It is suggested that a cooperative investigation be initiated to provide an answer to the support problem. (auth)

4669 TML-45
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
BRAZING AND SOLDERING OF TITANIUM. W. J. Lewis, G. E. Faulkner, and P. J. Rieppel. June 7, 1956. 26p. Contract AF-18(600)-1375.

This report is a summary of the information in published literatures and in Government research reports on the brazing and soldering of titanium, and includes a discussion of brazing and soldering procedures and also the properties of joints brazed with commercial and experimental filler metals. (auth)

4670 WADC-TR-52-251(Pt. III)
Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF COMPRESSIVE-CREEP PROPERTIES OF ALUMINUM COLUMNS AT ELEVATED TEMPERATURES. PART III. COMPARISONS WITH OTHER METALS. [Period covered] February 28, 1954 to February 1, 1955. R. L. Carlson and G. K. Manning. May 1955. 67p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF33(038)-9542. (AD-76872).

A clarification of the relation of the time-dependent tangent-modulus load—as conceived by Shanley—to column capacity is made. It may be interpreted as a limiting case of the "allowable load capacity." That is, it is an approximation to a conservative estimate. The approximation, however, can be either conservative or nonconservative. An application of the time-dependent tangent-modulus method is made to test results for Ti alloy RC-130A. The load-capacity estimates obtained are conservative for the test temperatures of 700 and 800°F. For temperatures and times for which the use of this alloy can be considered efficient, the estimates are considered satisfactory. An examination of data for alloys studied to date suggests that the difference between the temperature at which creep buckling becomes a design problem and the temperature above which loss in load capacity must be considered inefficient is small. Proper alloy selection in temperature zones in which a transition from one alloy to another becomes necessary requires a careful evaluation of the factors of importance in the given design situation. The creep-buckling data obtained on Al alloy 2024-T4 and on Ti alloy RC-130A indicate that the column load for a given failure time is approximately a constant fraction of the immediate-failure load for an appreciable range of slenderness-ratio values. An empirical ratio relationship based on this observation provides a simple means of extending creep-buckling data for one slenderness-ratio value to other values. The resistance of 302 stainless steel to creep and to creep buckling is good up to 1000°F. Since the resistance to time-independent plastic deformation is low, however, the load capacity of columns of this alloy cannot be considered exceptional at 1000°F. (auth)

4671 WADC-TR-52-322(Pt. 3)
Battelle Memorial Inst., Columbus, Ohio.
CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS. Summary Report [for] Period August 12, 1953 to August 12, 1954. A. J. Jacobs, R. P. Sopher, and P. J. Rieppel. Aug. 1954. 36p. Contract AF33(038)-12619. (AD-65474).

This report summarizes the third year of experimental work at Battelle on the causes of cracking in high-strength weld metals. During the period from August 12, 1953, to August 12, 1954, hot-tension and weld-metal cracking studies were conducted on SAE 43XX-type steels and other selected steels. Results from these studies showed a correlation, inasmuch as an increase in carbon, sulfur, and phosphorus tended to lower hot ductility and promote hot-crack susceptibility, and a misch metal addition seemed to give the opposite effects. (auth)

4672 WADC-TR-54-205(Pt.II)
Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF IMPROVED TITANIUM-BASE ALLOYS. Period covered: December 1953 to December 1954. Herbert A. Robinson, W. Maxwell Parris, and Paul D. Frost. June 1955. 103p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF 33(616)-384.

The heat-treated properties of 24 α-β Ti alloys have been evaluated. Mn, Mo, and V were the principal alloying additions. The strength-ductility relationships of these alloys increased with increasing alloy content up to about 7% alloy addition. The Ti-3Mn-complex alloy had room-temperature properties slightly better than those of any of the other alloys tested. However, a Ti-5Mn-2V alloy exhibited excellent elevated-temperature stability at 650°F. A binary Ti-8V alloy was very interesting in that it could be quenched from the beta-phase region and aged to give very good properties. Most alloys are embrittled as a result of being heated into the β-phase region. An evaluation of elevated-temperature properties of the Ti-3Mn-complex alloy indicated that the short-time tensile and 100-hr stress-rupture strengths were improved by heat treating initially to a tensile strength of 180,000 psi, instead of annealing to a level of 135,000 psi. However, there was no difference in the 1000-hr stress-rupture strengths for specimens initially heat treated to 135,000- or 180,000-psi strengths. It was found that pickling to remove the air-contaminated surface of alloy sheet added large amounts of hydrogen. A process was worked out for descaling and pickling Ti-alloy sheet without appreciable H pickup. Using this process, the Ti-3Mn-complex alloy sheet has been heat treated to 180,000-psi tensile strength with over 10% elongation in 1 in. Increasing the hydrogen content of the Ti-3Mn-complex alloy to 260 ppm decreased its tensile ductility and caused premature stress-rupture failures of notched specimens at room temperature. The H level that causes embrittlement in this alloy is a function of the heat-treated strength of the alloy. As the strength is increased through heat treatment, the H content required to cause embrittlement is decreased. (auth)

4673 WADC-TR-54-355(Pt.II)
Battelle Memorial Inst., Columbus, Ohio.
PRECIPITATION HARDENING AND EMBRITTLEMENT OF HIGH-STRENGTH TITANIUM ALLOYS. Period covered: April 1954 to February 28, 1955. W. M. Parris, C. M. Schwartz, and P. D. Frost. June 1955. 73p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF 33(616)-445.

The structure of the metastable transition phase, omega, which is involved in the age hardening of Ti alloys, was determined. It is a complex body-centered-cubic cell of the γ-brass type containing 54 atoms. The phase contains 3.7 at.% of the alloying element. The [100] directions of the Ω phase and the parent β phase are parallel. A tentative mechanism for the age hardening of Ti alloys is proposed. The formation of the Ω phase during aging was found to be inhibited by increasing alloy content. Leaner alloys which transformed to α prime upon quenching exhibited some degree of age hardening. Mechanical-property tests on quenched and aged Ti-4Fe and Ti-8Cr alloys confirmed

the severe embrittling effect of the omega phase. Further aging to convert omega to alpha resulted in high strengths with recovery of some ductility. Attempts to detect the omega phase by metallography or autoradiography were not successful. (auth)

4674 WADC-TR-55-362

Battelle Memorial Inst., Columbus, Ohio.

THE COLD EXTRUSION OF TITANIUM. [Period covered] June 1954 to July 1955. Alvin M. Sabroff and Paul D. Frost. Feb. 1956. 49p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2446.

Cold-extrusion studies were conducted on two grades of unalloyed Ti to evaluate the effects of die design and extrusion reduction. By utilizing a fluoride coating and a conventional oil–graphite–MoS_2 lubricant, forward extrusions with reductions of 40, 50, and 60% were successfully accomplished on 1½-in.-diameter by 3-in. billets. Conical dies with included angles of 90, 120, and 150° were used for each reduction. Working pressures were comparable to those required for cold extruding steel. For a given die angle, the extrusion pressure and average work of extrusion increased in an approximately linear relationship with the percentage reduction. Metal-flow studies were conducted on split billets inscribed with grids. Deformation by compression and elongation was uniform over the cross sections of the bars, with maximum shear deformation occurring in the outer fibers. The amount of shear deformation increased as the die angle and per cent reduction increased. Work hardening during extrusion was nearly uniform within the bars, the over-all hardness variation from center to surface being within 20 Bhn. Increases in strength varying from about 25 to 60% were produced under the various extrusion conditions. However, adequate ductility (elongation greater than 10% in 1 inch) was maintained. The extruded bars had a smooth surface finish, with few traces of galling. No measurable die wear occurred, indicating the fluoride coating functioned satisfactorily. Dimensional tolerances on the extruded bars were maintained within 0.001 inch. (auth)

4675 WAL-401/93-36

Case Inst. of Tech., Cleveland.

INVESTIGATION OF THE MECHANICAL PROPERTIES OF TITANIUM BASE ALLOYS. Final Report. E. L. Harmon, Jr., J. Kozol, and A. R. Troiano. May 1956. 91p. DA Project 593-08-021. Contract DA-33-019-ORD-1690.

Mechanical properties of a series of Ti alloys containing from 0 to 24% V were correlated with the transformation characteristics. Microstructural changes in Ti base alloys resulting from variation of alloy content and heat treatment influenced strength and ductility. Almost all the alloys studied are capable of producing both poor and relatively good properties depending upon the treatments employed. Differences may be very marked for only slight variations in treatment. Ti–V alloys show a sensitivity to heat treatment greater than most non-Ti base alloys in use. Heat treatment is a critical aspect of the utilization of Ti base alloys. (F.S.)

4676 WAL-401/203-6

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF TITANIUM-BASE ALLOYS OF HIGH STRENGTH AND TOUGHNESS. Interim Technical Report No. 5 [for] January 1 to April 30, 1955. C. R. Lillie and D. W. Levinson. Nov. 11, 1955. 19p. Project No. B-059. Contract DA-11-022-ORD-1428.

Tensile and impact properties of 28 Ti-base alloys are reported, as produced by various heat treatments. (auth)

4677 YE54-604

Sylvania Electric Products Inc., Metallurgical Labs., Bayside, N. Y.

UNIFORM ELONGATION OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 1 [for] March 1 to June 1, 1954. A. J. Opinsky, L. A. Sama, and L. L. Seigle. July 1954. 10p. Contract AF33(616)-2352. (AD-40023)

Research was undertaken to (1) determine which Ti-based alloys are most suitable for stretch-forming and drawing operations; (2) evaluate the effects of alloy additions, structure, strain rate, temperature, and anisotropy on the limit of uniform elongation; and (3) investigate the possibility of using a strain-induced transformation reaction as a means of improving the limit of uniform elongation. Several experiments were conducted to determine which is the best method for measuring uniform elongation. Tensile tests of Ti wires with large ratios of gage length to diameter indicated that uniform deformation continues to occur after maximum load. Results of measurements on sheet Ti indicated that the tensile elongation can remain uniform considerably past the maximum-load point. Results are reported on tensile measurements made on a bar of Ti 75A with an 8-in. gage length and a ⅜-in. diameter. (ASTIA abst.)

4678

ON INTERCRYSTALLINE STABILITY OF METALS DURING WELDING. N. N. Prokhorov. Izvest. Akad. Nauk S.S.S.R. Ser. Tekh. Nauk No. 11, 34-49(1955) Nov. (In Russian)

Investigations were made of the relation of deformation rate and metal plasticity in conditions of prevailing diffusion deformation. The results offer new data for the expansion of the previously suggested scheme on intercrystalline stability of metals during welding. (tr-auth)

4679

THE FORMATION OF AUSTENITE IN PLAIN CARBON STEELS AT HIGH HEATING RATES. Robert A. Huggins (Stanford Univ., Calif.), Harry Udin and John Wulff (Massachusetts Inst. of Tech., Cambridge). Welding J. (N. Y.) 35, 18s-26s(1956) Jan.

The formation of austenite in plain carbon steels at heating rates of 2000 to 20,000°C per second was studied, using ultra-high-speed pyrometry as well as conventional metallurgical techniques. Thin strips were heated rapidly by passing electric current longitudinally through them. The instantaneous temperature was measured by means of a lead sulfide photoconductive cell. A record of the temperature-time cycle undergone by the specimen was obtained by photographing the trace on a cathode-ray oscillograph. The effects of heating rate and prior structure upon the mechanism and progress of austenite formation were studied. Changes in heating rate within the range studied were found to have no appreciable effects. Prior structure, however, was found to be very significant, both with regard to the manner and the rate at which austenite formed. (auth)

4680

NICKEL AND HIGH-NICKEL ALLOYS FOR PRESSURE VESSELS. ABSTRACT OF AN INTERPRETIVE REPORT PREPARED FOR THE MATERIALS DIVISION OF THE PRESSURE VESSEL RESEARCH COMMITTEE. R. M. Wilson, Jr. and W. F. Burchfield (International Nickel Co., Inc., New York). Welding J. (N. Y.) 35, 32s-40s(1956) Jan.

Carbon Ni, Monel, Inconel, Hastelloy B and C, "K" Monel, and Inconel "X" can be fabricated into pressure vessels by conventional means. The physical and mechanical properties and metallurgy are discussed in detail. (J.E.D.)

4681

STRESSES IN WELDED PRESSURE VESSELS. W. P. Kerkhof (N. V. de Bataafsche Petroleum Maatschappij, The Hague, Netherlands). Welding J. (N. Y.) 35, 41s-59s(1956) Jan.

The allowable stresses, design stresses, and rupture theory for welded pressure vessels and boilers are discussed. (auth)

4682

THE METAL BERYLLIUM. D. W. White, Jr. and J. E. Burke, eds. Cleveland, American Society for Metals, 1955. 703p.

The topics discussed in the book on The Metal Beryllium cover the use in industry and the Atomic Energy Program, the occurrence and treatment of the ores, production by fluoride and sulfate extraction from beryl and electrolysis of BeO_2, fabrication, physical, mechanical, and nuclear properties, metallography of Be and Be alloys, corrosion in air, water, and liquid metals, refractory compounds and cermets of Be, refractory properties of the oxides, health hazards, and analysis. (J.E.D.)

4683

ZIRCONIUM—WHAT IS ITS FUTURE? Nucleonics 14, No. 2, 45-9(1956) Feb.

The physical characteristics of Zr are discussed. Its uses in the nuclear field are reviewed, and its applicability to other fields is shown to depend on cost reductions through improved processing techniques. (D.E.B.)

4684

EFFECT OF QUENCHING ON THE RESISTIVITY OF Au–Cd. M. S. Wechsler and T. A. Read (Columbia Univ., New York). J. Appl. Phys. 27, 194-5(1956) Feb.

Resistivity-temperature curves for 47.5 and 49% Cd–Au alloys are plotted for quenched and slow cooled crystallizations. Quenching is seen to increase resistivity and decrease transformation temperatures. (D.E.B.)

4685

THE MASS TRANSFER PROPERTIES OF VARIOUS METALS AND ALLOYS IN LIQUID LEAD. J. V. Cathcart and W. D. Manly (Oak Ridge National Lab., Tenn.). Corrosion 12, 87t-91t(1956) Feb.

The relative resistance of 21 metals and alloys to mass transfer in liquid lead has been measured. Tests were performed in small, quartz thermal-convection loops. The test temperature was about 800°C, with a thermal gradient of 300°C existing across the loops. Of the metals and alloys studied, only Nb and Mo exhibited a high resistance to mass transfer. Nickel and rich alloys were highly susceptible to mass transfer. Evidence is presented to show that alloys in which a tendency toward intermetallic compound formation exists show a higher resistance to mass transfer in liquid lead than do their pure-metal components. (auth)

4686

SELECTING MATERIALS FOR LIQUID SODIUM SYSTEMS. R. F. Koenig and E. G. Brush (Knolls Atomic Power Lab., Schenectady, N. Y.). Materials and Methods 42, No. 6, 110-14(1955) Dec.

In selecting materials for liquid Na systems, corrosion resistance to Na and Na impurities, known transfer characteristics, radioactivity transfer, and mechanical properties must be considered. These considerations are discussed, and the known data for some ferrous metals, Ni and Ni alloys, Cu and Cu alloys, refractory materials, and other metals and non-metals are tabulated. (D.E.B.)

4687

SAFE HANDLING OF ALKALI METALS. Marshall Sittig (Ethyl Corp., New York). Ind. Eng. Chem. 48, 227-9(1956) Feb.

Provision for specific storage facilities and safe handling of alkali metals are discussed. (auth)

Refer also to abstracts 4588 and 4733.

PHYSICS

4688 AD-73254

Stanford Research Inst., Menlo Park, Calif.

PREPARATION OF STANDARDS AND TEST PROCEDURES FOR PRINTED CIRCUITS. Scientific Report No. 3 [for] Period July 2, 1955 to October 1, 1955. E. R. Gamson. Sept. 1955. 26p. SRI Project 1276. Contract AF33(616)-2762.

The tentative specification for printed circuit boards will be a general performance specification. This form was selected because of the impracticality of providing a detailed specification for a product of such diverse forms, uses, and materials. New or improved base materials are being evaluated for inclusion in the specifications within this program. The solder-dip test is being employed to screen out materials which are not satisfactory. Development of test methods for determining data on properties which are unique to plastic base materials used for printed circuit applications is continuing. During this period, these investigations included studies of thermal expansion testing methods, methods of removing contaminants due to etching and of determining the extent of removal, and methods of testing the adhesion of metal to laminates. A study has been initiated to investigate methods of measuring and determining parameters affecting the electrical characteristics of the printed circuit base material. (auth)

4689 AECU-3199

RAND Corp., Santa Monica, Calif.

THE VALIDITY OF THE STATISTICAL THEORY OF PRESSURE BROADENING. Henry Margenau. Apr. 3, 1956. 8p. Contract AT(29-1)-1477. (RM-1670-AEC). $1.80(ph OTS); $1.80(mf OTS).

Proofs are developed for two propositions: (1) When a spectral line is broadened by single impacts of perturbing molecules and the half-width of the line is $\Delta\omega$, the statistical theory of broadening is applicable provided $\Delta\omega \cdot T >> 1$. (2) Far in the wings of a line the statistical theory is always applicable. (D.E.B.)

4690 ANL-5420

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] AUGUST 1954 THROUGH FEBRUARY 1955. May 1956. 188p. Contract W-31-109-eng-38. $1.00(OTS).

Experimental nuclear physics, mass spectroscopy, theoretical physics, and computer programs are reported. Neutron resonance parameters established by transmission measurements with the fast neutron velocity selector are tabulated for Th and U^{238}. Previously reported Van de Graaff malfunction due to textolite damage has led to a new design of texolite members. A complete set of structural members have been fabricated employing the new design. The effect of target uniformity on the neutron energy spread from Li targets was investigated. Plots of this effect indicate the necessity of uniform targets for work in which good resolution is required. The $B^{11}(d,\alpha)Be^{9}$ reaction at 1.5 Mev gives evidence of three excited states at 1.8, 2.4, and 3.1 Mev. Coincidence measurements on 33-hour Ce^{143} produced a new decay scheme containing 10 gamma energies. The spin states and transitions of Pu^{238} alpha decay are discussed and a decay scheme proposed. The decay schemes of Sb^{125} and Sn^{125} suggested by an analysis of pile irradiated Sn^{124} are constructed and discussed. A

method of total cross section determination for 14-Mev neutrons was devised which shows promise of greater accuracy than previous methods. This method requires four measurements; two with a scatterer and two without, one each inside and outside the neutron cone. The apparatus for angular distribution measurements on scattered neutrons was completed and operated. Differential scattering cross sections are plotted for Be, C, Al, Ti, Fe, Ni, Cu, Zn, Zr, Ag, Sn, and Pb. Further neutron resonance studies in the kev region are reported. The coupled equations for radial position, momentum, and phase oscillations in a synchrotron are treated by the use of difference equations. A treatment of adiabatic variation of parameters for systems of linear differential or difference equations is given. Formulas derived for various properties of FFAG accelerators are compiled. The notation is that adopted by MURA except that all symbolic quantities are positive. The effects of gas scattering in ordinary synchrotrons is extended to alternating gradient synchrotrons. Mechanical developments on scintillation counters and scintillation detector research are reviewed. Results of conduction measurements on plastic dielectrics are given. Currents were found to be both time and temperature dependent. Mass spectrometer abundance analyses were made on Kr, Ru, Xe, Zr and Y. (D.E.B.)

4691 DTMB-510

Gt. Brit. Ministry of Home Security.

THE VERTICAL MOTION OF A SPHERICAL BUBBLE AND THE PRESSURE SURROUNDING IT. (SW-19). (Includes Supplement (UNDEX-37)). G. I. Taylor. Aug. 1943. 33p.

Digest by E. H. Kennard, David W. Taylor Model Basin.

The upward motion of the spherical hollow which is formed in water by an explosion is discussed on the assumption that the spherical form is preserved. During the expanding stage the buoyancy of the hollow gives a large amount of vertical momentum to the surrounding water. During the contracting stage this momentum is concentrated around a rapidly diminishing volume. An intense concentration of vertical momentum is thus produced in the neighborhood of the vertical line through the charge. The pressure at points above the charge and near this line rises to considerable values owing to two causes: when the hollow is near its greatest contraction at the end of its first oscillation its center is nearer to points vertically above the seat of the explosion than it was at the time of the explosion, but farther from points on the level of the explosion; and, the pressure due to the combination of vertical motion and expansion on the second expansion is in certain circumstances large. For comparison with observation, the maximum displacements to be expected in a rectangular plate 6 feet by 4 feet by 0.173 inch attacked by 4.65 pounds of TNT placed 14 feet below the plate and 14 feet away horizontally, are calculated. They are found to be 4.3 inches and 1.5 inch respectively. The observed displacements were 4.35 inches and 1.15 inch. (auth)

4692 NAVORD-3847

Naval Ordnance Lab., White Oak, Md.

AN EQUATION OF STATE FOR WATER AT EXTREME PRESSURES. J. H. Rosenbaum. Nov. 1, 1954. 22p. (AD-55229).

A new equation of state for water is derived from theoretical considerations. This is used to obtain a smoothed extrapolation of Bridgman's P-V data to extremely high pressures. (auth)

4693 NP-5970

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 20. Apr. 15, 1956. 70p. Contract N5ori-07856.

The mathematics of projection operators and the configuration interaction problem are discussed. A rigorous treatment of the superexchange mechanism is made by using the spin projection operators of Lŏwdin. The use of the one-center method to calculate molecular binding energies is described, and applications to the CH_4 and LiH molecules are discussed. Results of calculations for the electronic binding energy of the LiH molecule are summarized in detail. Potential curves are given, and binding energies are tabulated. Polarization effects in the fluorine ion were studied. Multi-center integral techniques are described. The general procedure consists of expanding all wave functions about a single center in terms of spherical harmonics and then calculating the resultant single-center integrals by numerical quadrature. Work was continued on the electronic structure of KCl and KCl with a V-center. Some calculations were also made on the electronic structure of Fe. Methods of calculating wave functions are discussed. Approximations to electronic wave functions by combination of multi-particle orbitals are discussed. (For preceding period see NP-5949.) (B.J.H.)

4694 NP-5977

Columbia Univ., New York. School of Engineering.

DEPARTMENT OF INDUSTRIAL ENGINEERING STATISTICAL ESTIMATION OF THE ENDURANCE LIMIT. Technical Report T-6A. E. J. Gumbel. May 1, 1956. 37p. Contract DA-30-069-ORD-1061. (CU-6-56-ORD-1061-IE).

A statistical procedure for the estimation of the endurance limit is proposed. The tool used for the estimation was the probability of permanent survival, which is a function of the fatigue stress. This probability was estimated from the numbers of specimens that failed or survived a certain stress. The data are analyzed by the asymptotic theory of smallest values of a non-negative variate. Numerical examples are given to show how the procedure can be carried through. It was also seen that the amount of data now available is barely sufficient to warrant numerical results. (B.J.H.)

4695 NP-5980

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

TUBE LABORATORY MANUAL. Second Edition. Fred Rosebury. Jan. 15, 1956. 134p. DA Project 3-99-10-022. Contract DA-36-039-sc-42607.

Procedures for cleaning, electroplating, heat treating, and assembling vacuum tube components are outlined. The characteristics of components used are discussed, and their properties tabulated. (D.E.B.)

4696 NP-5983

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

FOURTH ANNUAL REPORT [FOR] JULY 1954—JUNE 1955 OF THE DUCTH—NORWEGIAN. Feb. 1956. 37p.

4697 NYO-7486

Franklin Inst. Labs., for Research and Development, Philadelphia.

TECHNICAL PROGRESS REPORT. June 1956. 24p. Contract AT-(30-1)-1484. $4.80(ph OTS); $2.70(mf OTS).

Diffusion runs were made at eight temperatures in the range from 700 to 950°C, for times ranging from 5 to 45 hours. A linear curve of the logarithm of the activity plotted against the square of the penetration depth was obtained for all samples. The results for individual samples are summarized, a plot of the logarithm of the diffusion coefficients as a function of the reciprocal of the absolute temperature is given. (auth)

4698 PR-P-29

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] JANUARY

1, 1956 TO MARCH 31, 1956. 94p. (AECL-316).

The mechanism of thermonuclear reactions in stars has been investigated. Carbon cycle statistics, α particle spins, neutron abundance, and heavy element production are discussed. Modifications in fast coincidence equipment for mμs lifetime experiments are described. Parameters for the Fe-free β-ray spectrometer are given. Nd^{147} and Pm^{147} β and γ spectra were examined. Eight conversion electrons corresponding to gamma energies were observed in the Nd^{147} decay. No transition from Nd^{147} to Pm^{147} ground states was detected. Measurements on the time distribution of positron annihilations in solutions gives information on ortho-para positronium conversion by dissolved substances. Cu^{2+}, Co^{2+}, and Fe^{3+} have strong quenching effects while H^+, Na^+, Ca^{2+}, Zn^{2+}, and Cl^- have little or no effect. The NO_2^+ and NO_3^- ions show an intermediate effect between the above two groups. New measurements of Pu^{239} conversion factors and capture cross sections have been made using NRX rods. Values for two samples were 0.75 ± 0.02 and 0.77 ± 0.01, and 425 ± 6 and 431 ± 10 barns. Production rates were 0.90 and 0.93 g/Mwd. The characteristics of Al^{25} excited states; He^3 reactions with Be^9, C^{12}, and Li^7; and N^{14} 3.95-Mev gamma decay were investigated. Experimentally observed branching ratios in Al^{25} are compared with theoretically predicted values. The neutron and alpha particle yields from Be^9 + He^3 were similar, differing from the proton yield which has a cut-off at 2 Mev. The broad maximum in the $C^{12}(He^3, p)N^{14}$ reaction was established at 1.28 Mev rather than at 1.18 Mev as previously reported. An attempt was made to establish the effects of ferromagnetic spin wave quanta on neutron scattering. Energy distribution of 1.52 A neutrons scattered from a Fe_3O_4 single crystal at 12 orientations have been made, showing energy peaks in each orientation. Correlation with spin wave energies is in progress. The energy resolution of the slow neutron chopper was improved by reducing the energy spread of the incident neutrons. Analysis of the Eu^{153} gamma spectrum revealed two emissions at 86.10 and 88.67 kev in addition to the established three rays. Angular correlations of photons from positron annihilation in 34 elements were measured. Progress notes are given on the development of switching transistors, kicksorters, scaling systems, pulse height analyzers, and detection instruments. Calculations of neutron flux hardening in natural U rods led to a ratio of 1.09 between the velocities of neutrons within the rod and in the in-current. Theoretical investigations of binary fission, surface effects in nuclear reactions, magnetic focusing, nuclear charges in irradiated U, and neutron diffraction in gases are reported. (For preceding period see PR-P-28.) (D.E.B.)

4699 RIA-54-1989

Rock Island Arsenal Lab., Ill.

A MECHANICAL DIPPING APPARATUS FOR THE PRODUCTION OF CONTROLLED COATING THICKNESS ON TEST PANELS. Report No. 24. Linden H. Wagner and William F. Garland. June 4, 1954. 28p. DA Project No. 593-21-055. (AD-33965)

A mechanical dipping apparatus consisting of a constant-temperature bath with a manually operated electrical switch was constructed for the controlled immersion and withdrawal of test panels into and out of a molten petrolatum-base type preservative. The influence of the following variables on the uniformity and coating thickness was determined: immersion time, withdrawal rate, panel thickness, and application temperature. Tests were conducted in which each of the above variables was separately investigated while the 3 remaining basic values were retained. Results indicated that the apparatus was suitable for the preparation of uniform coatings of specified coating thickness on test panels; satisfactory repeatability and reproducibility were provided. (auth)

4700 WADC-TR-54-585

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.

GENERALIZED CHARTS OF DETONATION PARAMETERS FOR GASEOUS MIXTURES. Bernard T. Wolfson and Robert G. Dunn. Mar. 1956. 21p. Project title: RAMJET TECHNOLOGY.

Generalized charts of detonation parameters for gaseous mixtures, involving only dimensionless quantities, are presented. These charts are plots of generalized equations, previously presented by the authors, derived directly from the classical equations of detonation. It is shown that the chief usefulness of the generalized charts is to provide a means for visualization of all relationships among the detonation parameters for gaseous mixtures on a small number of Mollier-type diagrams. The use of the generalized charts is illustrated by several examples involving gaseous mixtures. (auth)

4701 AERE-Lib/Trans-496

ON THE BROADENING OF SPECTRAL LINES. J. Holtsmark. Translated by J. B. Sykes from Ann. Physik 58, 577-630(1919). 40p.

Quantitative theory of spectral line broadening is developed for the cases in which the molecules are ions, dipoles, and quadrupoles. The half-width of the lines is shown to be a function of density and the electrical constants of the broadening atoms. The theory is substantiated by experiment. (D.E.B.)

4702

ON CHANGES IN THE DOMINANT FREQUENCIES OF SEISMIC WAVES WITH INCREASED DISTANCE FROM THE SOURCE OF VIBRATION. I. S. Berzon (Inst. of Geophysics) Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. No. 1, 3-22(1956) Jan. (In Russian)

The character of the dominant seismic wave frequency changes with the distance from the source of vibration, and the effects of absorption properties in concrete media are discussed. A possibility of step-wise changes in prevailing frequencies of straight, reflected, and refractory waves expanding into an absorption media are demonstrated. Explosion spectra effects, seismograph installation conditions, and the selection of a specific seismograph suitable to receive the wave dominant frequencies and their changes with distance are discussed. (tr-auth)

4703

ON CERTAIN TYPES OF SEISMIC WAVES. A. M. Epinat'eva. (Inst. of Geophysics) Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz, No. 1, 23-36(1956) Jan. (In Russian)

Theoretical and experimental data are given for the kinematic and dynamic characteristics of multiple reflected and reflecto-refracted waves. The first reflection occurs from the crevice boundary, located above the vibration excitation source. The experimental data agree with theory. (tr-auth)

4704

ELECTRIC CONDUCTIVITY OF ALUMINUM OXIDE AND ZINC OXIDE AT HIGH TEMPERATURES. P. T. Oreshkin. Zhur. Tekh. Fiz. 25, 2447-50(1955) Dec. (In Russian)

The electroresistance of aluminum oxide and zinc oxide was measured in the temperature range up to 1300°C. Some positive results were obtained for aluminum oxide at high temperatures; for zinc oxide, the results showed that at 1000°C the zinc oxide resistance became negligible. (R.V.J.)

4705

HELP IN DESIGNING PRESSURE VESSELS. R. W. Schneider (Travelers Insurance Co., Hartford, Conn.). Chem. Eng. 63, No. 2, 171-3(1956) Feb.

A rapid graphical method of estimating maximum stresses accurate enough to justify use of minimum safety factors of pressure vessels with flat heads is discussed. (auth)

4706

TEMPERATURE: ITS MEASUREMENT AND CONTROL IN SCIENCE AND INDUSTRY. VOLUME II. Hugh C. Wolfe, ed. New York, Reinhold Publishing Corp., 1955. 467p. London, Chapman and Hall, Ltd.

The papers presented at the Third International Symposium on Temperature are contained. Included are 4 papers on general temperature concepts, 9 papers on temperature standards and scales, 2 papers on temperature transient phenomena, 6 papers on experimental temperature measuring techniques, and one paper on atomic explosion temperatures, high-temperature ionization measurement,and upper atmosphere temperatures. (D.E.B.)

4707

APPARATUS FOR THE STUDY OF THE EFFECT OF DISSOLVED GASES ON THE SURFACE TENSION OF LIQUIDS AT ELEVATED TEMPERATURES AND PRESSURES. Martin K. Barnett and Edward Orban (Mound Lab., Miamisburg, Ohio). Producers Monthly 20, 22-5(1955) Nov.

Apparatus constructed for the purpose of measuring the surface tension of liquids while saturated with oxygen at elevated temperatures and pressures is described. The design temperature range extends to 250°C and pressure to 2500 lbs./in^2. (D.E.B.)

4708

THERMODYNAMIC PROPERTIES OF LIQUID He^3 BETWEEN 0.23° AND 2° K. Darrell W. Osborne, Bernard M. Abraham, and Bernard Weinstock (Argonne National Lab., Lemont, Ill.). Paper No. 26 in Conference of Low Temperature Physics held in Paris, September 2–8, 1955.

The heat capacity and entropy have been measured and plotted. Plots of calculated values are also given for comparison. (D.E.B.)

4709

RADIATION-CONTROLLED ELECTROLUMINESCENCE AND LIGHT AMPLIFICATION IN PHOSPHOR FILMS. D. A. Cusano (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 98, 546-7(1955) Apr. 15.

When voltage is applied to ZnS:Mn, Cl phosphor during excitation by ultraviolet or x rays the brightness was found to increase by factors as large as 80. (D.E.B.)

AEROSOLS

4710

RADIOACTIVITY OF THE ATMOSPHERE. Hubert Farrigue. Compt. rend. 241, 1971-2(1955) Dec. 19. (In French)

Radioactive rain, frost, and snow were studied. The maximum observed on Nov. 25, 1955 was equivalent to 10 atoms of medium energy β emitters per cc of atmosphere and whose half life was 35 days. (tr-auth)

ASTROPHYSICS

4711

ON THE CONTENT OF LITHIUM, BERYLLUM, AND DEUTERIUM IN THE SOLAR ATMOSPHERE. I. S. Shklovskiĭ (Shternberg State Inst. of Astronomy) Doklady Akad. Nauk S.S S.R. 105, 931-4(1955) Dec. 11. (In Russian)

The assumption that Li, Be, and D_2 are reproduced in the outer layer of the sun, and the possible mechanisms of such reproductions are discussed. (R.V.J.)

COSMIC RADIATION

4712 OSR-TN-56-234

Maryland. Univ., College Park.

THE PRIMARY COSMIC RADIATION AND ITS TIME VARIATIONS. Physics Department Technical Report No. 40. S. F. Singer. May 22, 1956. 144p. Contract AF18(600)-1038. (AD-88354).

A review article devoted to analyzing experimental data on primary radiation in order to obtain its composition and the energy spectra of the various components is presented. 185 references. (F.S.)

4713 AERE-Lib/Trans-644

PROCESSES OF FORMATION OF HEAVY MESONS AND V_1^0-PARTICLES. B. M. Pontecorvo. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 29, 140-6(1955). 11p.

The processes of formation of V_1^0-particles and heavy mesons are discussed from the phenomenological point of view. The mechanism of the simultaneous origin of V particles and heavy mesons is considered. The possibility is discussed of the existence of relatively stable systems consisting of nucleons and V particles. A detailed examination is made of the difficulties connected with the explanation of the existence of particles originating with high probability but having a prolonged lifetime. The conclusions drawn in this work may help in the formulation of working hypotheses during the interpretation of experimental data and in discussion of the possibility of devising experiments on the formation of new particles. (auth)

4714

A NEW UNSTABLE SMALL PARTICLE IN COSMIC RADIATION. M. Deutschmann (Max Planck Inst. for Physics, Gottingen, Germany). Naturwissenschaften 42, 499-506 (1955) Sept. (In German)

4715

HIGH ENERGY NUCLEAR DISINTEGRATIONS. M. Baldo-Ceolin and B. Sechi (Univ. of Padua and National Inst. of Nuclear Physics, Padua). Nuovo cimento (10) 2, 1202-10 (1955) Dec. (In Italian)

The scope of this paper is to study nuclear disintegrations produced by high energy primaries ($E_p \gtrsim 5$ Bev), and to show how and in what manner the mesons created in the nucleus can influence the interaction. We have studied disintegrations produced in nuclear emulsions, exposed to the cosmic radiation at an altitude of 27 km. The ionization of the tracks, their energy distribution, their angular distributions and angular correlations, have been analyzed for 150 stars. Some phenomena such as the anomalous angular distribution of black tracks, i.e. the decrease of angular anisotropy with increasing energy of the nuclear disintegration, and the excess of angles near 180° between black and grey tracks, have been interpreted as due to the reabsorption of π mesons in the nucleus. The curve for the energy distribution of the grey prongs shows a step for energies below 100 Mev, which can be interpreted as due to the scattering of π mesons in nuclear matter. This hypothesis was reached by considering that the cross section for scattering of pions in nuclei, shows a maximum for a kinetic energy of the incident mesons of about 180 Mev, and that the differential cross section gives a prevalently backward scattering. This leads to the prediction that mesons created in the nucleus with energies of about 180 Mev will have much shorter scattering mean free path than other mesons, and that they will more frequently yield a large part of their energy to the recoil nucleon. These views have been checked by 500 "Monte Carlo" extractions to obtain the energy distribution curve of the protons emitted by the nucleus after a collision $\pi^+ + p \rightarrow \pi^+ + p$. The

spectrum which is thus obtained shows a marked variation in the region of 100 Mev. (auth)

4716

A VARIATION OF THE RATE OF PENETRATING EXPANSIVE SHOWERS WITH SIDEREAL TIME. C. B. A. McCusker (Dublin Inst. for Advanced Studies, Ireland). Nuovo cimento (10) 2, 1340-1(1955) Dec. (In English)

Rates of extensive showers, averaged over four hourly periods for the six periods of the sidereal day are tabulated. No variation of the rate with sidereal time could be established from these data. (B.J.H.)

4717

SOME REMARKS ON THE ASYMPTOTIC BEHAVIOUR OF THE COSMIC RAY CASCADE FOR LARGE DEPTH OF THE ABSORBER. I. ESTIMATION OF THE FACTORIAL MOMENTS. K. Urbanik (Polish Academy of Science, Wroclaw). Nuovo cimento (10) 2, Suppl. No. 4, 1147-9(1955).

A mathematical estimation of the factorial moments of nuclear cascades in homogeneous matter is developed. (D.E.B.)

4718

SOME REMARKS ON THE ASYMPTOTIC BEHAVIOUR OF THE COSMIC RAY CASCADE FOR LARGE DEPTH OF THE ABSORBER. II. ASYMPTOTIC BEHAVIOUR OF THE PROBABILITY DISTRIBUTION FUNCTION. J. Lopuszański (Polish Academy of Science, Wroclaw). Nuovo cimento (10) 2, Suppl. No. 4, 1150-60(1955).

A mathematical treatment of the probability function of nuclear cascades in homogeneous matter is given. (D.E.B.)

4719

SOME REMARKS ON THE ASYMPTOTIC BEHAVIOUR OF THE COSMIC RAY CASCADE FOR LARGE DEPTH OF THE ABSORBER. III. EVALUATION OF THE DISTRIBUTION FUNCTION. J. Lopuszański (Polish Academy of Science, Wroclaw). Nuovo cimento (10) 2, Suppl. No. 4, 1161-7 (1955).

Formulas for numerical computations of the cascade distribution function are derived and their applicability discussed. (D.E.B.)

4720

OBSERVATIONS OF THE ENERGY-SPECTRUM OF THE COSMIC RADIATION BELOW GROUND. E. P. George and G. S. Shrikantia (Univ. of Sydney, Australia). Nuclear Phys. 1, No. 1, 54-66(1956).

In nuclear research emulsions exposed at a depth of 57 mwe the momentum of 400 particles was determined by multiple scattering measurements on long tracks. 317 occurred within 30° of the vertical, and for this group the momentum spectrum in the range $0 < p < 40$ Bev/c was found to be consistent with a law of the form usually assumed $N(p) \sim (p + p_0)^{-\gamma}$ with $p_0 = 12$ Bev/c and $\gamma = 3$. Particular attention was paid to the momentum interval 0 to Bev/c and no evidence of any anomalies were found. The distribution in angle of the tracks was found to be consistent with a law of the form $\cos^n \theta$ with $n = 2.7 \pm 0.2$. For those tracks with grain density at least 1.2 times the plateau value the exponent was found to be 3.7 ± 0.25. These values correspond to exponents of the cosmic radiation equal to 1.7 ± 0.2 for the fast tracks and 2.7 ± 0.25 for the slow. (auth)

4721

ORIGIN OF COSMIC RADIATIONS. C. Y. Fan (Yerkes Observatory, Williams Bay, Wis.). Phys. Rev. 101, 314-19(1956) Jan. 1.

Based upon recent developments of hydromagnetic turbulence, the interaction of a cosmic-ray particle and a moving interstellar cloud is investigated. It is found that the particle can be accelerated by an inductive mechanism with a comparable efficiency to Fermi's mechanisms of collision. However, the efficiency is the highest when the particle is trapped between two interstellar clouds and is accelerated by the combined action of the two mechanisms in a "push-pull" manner. It is suggested that cosmic radiations are primarily accelerated by such a "push-pull" mechanism in some favorable regions in our galaxy. (auth)

4722

MODIFIED FERMI MECHANISM FOR THE ACCELERATION OF COSMIC RAYS. Leverett Davis, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 101, 351-8(1956) Jan. 1.

Fermi's treatments of the acceleration of cosmic rays are generalized by including the statistical fluctuations in the number of accelerating and decelerating interactions of a particle with a varying magnetic field. This alone does not greatly change the result, a power-law energy spectrum still being obtained. However, interactions, not considered by Fermi, in which the average energy change is zero may now contribute much, or all, of the acceleration. In particular, in his second model, where the galactic magnetic field is roughly uniform along the spiral arm of the galaxy, standing hydromagnetic waves now accelerate and decelerate particles by "betatron" collisions. To get the observed energy spectrum requires rms gas velocities of 10 km/sec in oscillations whose extensions normal to and parallel to the field are of order 1 and 7 light years, respectively. The observed near-isotropy of cosmic rays may be explained by inhomogeneities in the magnetic field of scale small compared to the helix radius. These can be numerous enough to produce near-isotropy without being so numerous that the particle is less likely to diffuse to the end of the spiral arm than to make a nuclear collision. It is speculated that, because of the statistical effects, fluctuating stellar magnetic fields may accelerate a few particles in a small-scale version of Fermi's first model and thus solve the injection problem. (auth)

4723

INTERACTION OF COSMIC RAY PROTONS WITH LIGHT NUCLEI ACCORDING TO MEASUREMENTS TAKEN WITH WILSON CHAMBER AT 9 KM ALTITUDE. L. T. Baradzeĭ, V. I. Rubtsov, Yu. A. Smorodin, M. V. Solov'ev, B. V. Tolkachev, and Z. I. Tulinova. (Lebedev Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 502-7(1955) Sept.-Oct. (In Russian)

The investigation of cosmic proton interaction with nuclei at high altitudes was facilitated by the high intensity of protons and negligible content of π mesons in the nuclear active component. The measurements of proton interactions with beryllium nuclei Be^9 were made with a Wilson chamber of ϕ 200 mm and illumination depth of 500 mm. The chamber was working in a magnetic field with strength of 9000 Oe. A beryllium plate of 5.3 g/cm^2 was placed in the chamber for measuring the space angles between the shower particles and the primary particle traces over the plate. The measurement error for the space angles was within 1°. The particle angular distribution in the showers and the data on impulses are given. (R.V.J.)

4724

ENERGY SPECTRUM OF PROTONS AT 3200 m ABOVE SEA LEVEL. N. M. Kocharyan, G. S. Saakyan, M. T. Aĭvazyan, Z. A. Kirakosyan, and A. S. Aleksanyan. (Armenian Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 515-18(1955) Sept.-Oct. (In Russian)

Spectra of protons in the impulse range of $p < 2$ Bev/c was determined in previous works. With high impulses the copper absorbers located under the magnetic clearance prevented the direct separation of the proton beams from the

π-meson beams. Nevertheless, this division was obtained indirectly by investigations of the interaction of the particles in the absorber and the observation of the phenomenon that μ mesons do not interact with nuclei while the protons do. The measurements were taken under the magnetic clearance from six copper absorbers with total surface density of 178 g/cm^2. μ mesons which stopped in these absorbers had impulses of $p \lesssim 0.4$ Bev/c. Protons with $p \lesssim 1.1$ Bev/c impulses were stopped because of ionization, but with large impulses they stopped because of internuclear interactions. (R.V.J.)

4725

IONIZATION SPECTRA OF PARTICLES OF COSMIC RADIATION IN THE STRATOSPHERE. I. D. Rapoport (Lomonosov Moscow State Univ.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 519-24(1955) Sept.-Oct. (In Russian)

Measurements of cosmic ray intensities according to the number of charged particles and study of the ionization created by these particles in the stratosphere indicated the presence of a well defined beam of ionized particles which contribute $\frac{1}{3}$ to the total ionization. Experiments were made (for finding the origin of these strongly ionizing particles) to determine the spectrum of cosmic ray particles according to the ionization created by them. These works were carried out during the years of 1951 to 1953 in Moscow at the local latitude. Two variations of experiments were used, in the first the investigation of vertical particle beams with the range larger or equal to 1.7 g cm^{-2}, and in the second, ionization impulses were registered independently from the range or direction of the particle motion with the minimum registration limit of 0.4 order and mean impulse created by a relativistic particle. Both experiments were carried out simultaneously at the same installation with a small, spherical, thin-walled aluminum ionization chamber with gas volume (spectrochemically pure argon) of 8 l and with an impulse collecting time of $\sim 5 \times 10^{-5}$ sec for the electronic component. (R.V.J.)

4726

INVESTIGATION OF IONIZING PROPERTIES OF COSMIC RADIATION AT 3200 m BY MEANS OF SCINTILLATION PROPORTIONAL COUNTERS. L. P. Kotenko (Lebedev Inst. of Physics) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 525-32(1955) Sept.-Oct. (In Russian)

Stilbene and naphthalene crystals of 17 × 24 × 24 and 14 × 11 × 21 mm were used in the investigation of ionizing properties of cosmic radiation. The evaluation based on three series of measurements gave the number of protons in the soft component as 4.8% of the total hard component, a percentage obviously too high. A certain number of electrons and mesons could have been added to the number of strongly ionizing particles (protons). By subtracting the number of electrons and mesons from the number of ionizing particles (based on the electron and meson distribution), a value for the number of protons of 3.5% was obtained. Finally, the number of strongly ionizing particles or protons stopped by ionization losses in 7.5 cm of lead at 3200 m under 30 g. cm^{-2} layer of light matter was 3.5 ± 1% of the hard component, which corresponds to a vertical proton beam with 0.8 Bev/c impulses, and which equals impulses, and which equals to $(2.1 \pm 0.6) \times 10^{-3}$ (Bev/c)$^{-1}$ cm^{-2} sec^{-1} ster^{-1}. Determination of the most probable ionization losses are given in an appendix. (R.V.J.)

4727

INVESTIGATION OF ORIGIN OF COSMIC RAY COMPONENTS IN THE STRATOSPHERE AT GEOMAGNETIC LATITUDE 51°N. P. N. Ageshin, A. N. Charakhch'yan, and T. N. Charakhch'yan (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 533-6(1955) Sept.-Oct. (In Russian)

The available data for π^0 and π^+ meson spectra generation in the stratosphere and their decay scheme make it possible to calculate the electron-photon component transmissions through the atmosphere and to determine the electron energy spectra at various elevations. Experimental study to determine the relation of the number of soft component particles to the elevation, in transmission interval, of 0.4 to 0.9, 1.2 to 2.0, 2.0 to 6.6, on 6.6 to 11.3 g cm^{-2} glass or aluminum, was made with the counter telescope at 51°N latitude. The measurements of the particle numbers in the indicated intervals were made simultaneously with four telescopes in a single exposure of the equipment in the stratosphere. Two series of measurements gave results which coincided within the limits of statistical error. The presence of a large number of low-energy electrons at shallow depth, the continuous softening of electron transmission spectra with reducing depths, and the great effect of latitudes on low-energy electrons call for new assumptions about the existence of a special mechanism for generating electron-photon components of low energies in the stratosphere. (R.V.J.)

4728

NARROW AIR SHOWERS IN THE STRATOSPHERE. P. N. Ageshin, A. N. Charakhch'yan and T. N. Charakhch'yan. (Lomonosov Moscow State Univ.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 537-40(1955) Sept.-Oct. (In Russian)

Experimental measurements made in the stratosphere indicated a considerable number of coincidences caused by particles of side showers in cases where the counting telescope lacked one of its filters. The studies showed that these side showers can be interpreted as narrow air showers in the atmosphere. Schemes and diagrams of the experimental investigations are given. (R.V.J.)

4729

SOME RESULTS OF THE INVESTIGATION OF SPALLATION OF W, Cu, AND Al, BY COSMIC RAYS. Zh. S. Takibaev. (Physico-Technical Inst. Kaz. S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 541-5(1955) Sept.-Oct. (In Russian)

Tungsten, copper, and aluminum wires of 50 to 200μ were used in the investigation of nuclear spallation in pure elements. The wires were placed in a single, parallel row and pressed between the photoplates of the emulsion facing each other. The photoplate emulsion thickness was about 1200 to 1500μ and the total thickness of the photoplate pile was 5 cm. After the photoplate and film exposure to the cosmic rays on mountain peaks or in the stratosphere the wires were removed and the plates and films were developed under various conditions. Diagrams and tables of the distribution of the stars formed in W, Cu, Al and the number of gray traces (N_g) in relation to the total number of prongs (N_h) of the star are given. The measurements were made at the elevation of 4375 m and in the stratosphere. (R.V.J.)

4730

INTERACTION OF COSMIC RAY PARTICLES OF 10^{10} TO 10^{11} ev WITH LIGHT NUCLEI MEASURED AT 4Km ELEVATION. N. G. Birger, V. V. Guseva, G. B. Zhdanov, S. A. Slavatinskiĭ, and G. M. Stashkov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 546(1955) Sept.-Oct. (In Russian)

Most of the observed showers had four or more charged particles. The mean of the angular distribution of shower particles in the center of gravity of the two colliding nucleons was symmetric and close to isotropic. Also, the spectrum of shower particle momenta formed in the light matter was obtained in the interval of 5×10^8 to 3×10^9 ev/c. (R.V.J.)

4731

TRANSITION CURVES FOR AIR-LEAD AND THE ANGULAR DISTRIBUTION OF SINGLE COSMIC RAY PARTICLES.

A. P. Zhdanov and P. I. Fedotov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 547(1955) Sept.-Oct. (In Russian)

Refer also to abstracts 4480, 4782, 4820, and 4825.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4732 TAM-86

Illinois. Univ., Urbana.

BUBBLE RAFT MODEL OF CRYSTAL FATIGUE. Technical Report No. 44. G. M. Sinclair and H. T. Corten. June 1955. 18p. Project NR-031-005. Contract N6-ori-071 (04). (AD-66787).

"Studies were made of the behavior of vacancies and dislocations in a bubble raft model of a crystal which was subjected to completely reversed cyclic shear. It was found that lattice vacancies tend to condense or collect to form the nucleus of a 'crack' at a rate which depends on the amplitude of the reversed shear. Growth of the 'crack' occurs when additional vacancies are transported to the nucleus by moving dislocations. A possible mechanism of fatigue of metal crystals is suggested in terms of the behavior of imperfections in the bubble model." (F.S.)

4733 AERE-Lib/Trans-522

STRUCTURE AND TYPE OF DISTRIBUTION OF TRULY SOLID BODIES AND CATALYSTS. SECTION C. THE ENERGETICS OF THE STRUCTURE OF SOLID SURFACES. SURFACE ENERGY OF SOLID SUBSTANCES AND THE ENERGY CONTENT OF ACTIVE SITES. R. Fricke. Translated by R. J. Richardson from "Handbuch der Katalyse. Vol. 4. Heterogene Katalyse I." G. M. Schwab, ed. Vienna, Springer-Verlag, 1943. 12p.

Surface energies of several metal crystals are calculated from heats of sublimation and energy contents of atom location. The relationship of crystal structure to specific free surface energy is discussed. (C.W.H.)

4734

X-RAY DISPERSION EFFECTS IN CRYSTAL-STRUCTURE DETERMINATIONS. David H. Templeton (Univ. of California, Berkeley). Acta Cryst. 8, 842(1955) Dec.

4735

THE LENGTH OF THE URANYL ION IN URANYL CARBONATE. Don T. Cromer and Paul E. Harper (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 8, 847-8(1955) Dec.

4736

THE δ PHASE FOUND IN THE U–Zr ALLOYS. Melvin H. Mueller (Argonne National Lab., Lemont, Ill.). Acta Cryst. 8, 849-50(1955) Dec.

4737

SURFACE STUDIES OF X-RAY IRRADIATED POTASSIUM CHLORIDE CRYSTALS. Walter J. Smith, William J. Levio, and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 101, 37-40(1956) Jan. 1.

Multiple-beam interferometry has been used to investigate the surfaces of x-ray irradiated KCl crystals. Within the limits of the method there is no evidence for diffusion of vacancies or ions to or from the surface to account for the observed decrease in density. The change of density thus must be attributed to an internal mechanism, a possibility which finds tentative experimental support. (auth)

4738

SPECTRAL DISTRIBUTION IN THE SELF ABSORPTION REGIONS OF VARIOUS CRYSTALS. Yvette Cauchois. Compt. rend. 242, 100-2(1956) Jan. 4. (In French)

Observations relative to the perturbations of the intensity of x radiation, which is selectively reflected by a crystal in diffusion and anomalous dispersion regions, are discussed. (tr-auth)

Refer also to abstract 4545.

ELECTRICAL DISCHARGE

4739 AERE-T/R-1792

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE WRIGGLING DISCHARGE IN FREE SPACE. S. J. Roberts, P. A. Sturrock, W. B. Thompson, and R. T. P. Whipple. Nov. 1955. 33p.

An attempt is made to study the properties of a wriggling discharge by considering the forces acting on a simplified model; – a thin extensible wire. These are calculated to a linear approximation for an arbitrary plane distortion and the discharge is shown to be unstable. For a sinusoidal distortion the force is calculated and shown to be proportional to the product of the displacement, curvature of the current channel, the square of the current and the negative of the logarithm of the products of wave number and wire radius, thus: 1) $F = I^2\eta''(x) \log 2/k\epsilon$. For this configuration the first non-linear terms are discovered as of third order in the displacement, and for a sinusoidal disturbance to contain the third harmonic, hence to distort the discharge into a more peaked configuration. The forces acting on a helical channel are calculated, and in certain circumstances are shown to produce maximum instability for a 45° pitch. Finally, the forces on an isolated arc are investigated, and it is shown that the approximate formula 1) is useful if the curvature is constant, and if $\epsilon/a < 1/20$, where ϵ = radius of discharge, a = radius of curvature. (auth)

4740 UCRL-4688

California. Univ., Livermore. Radiation Lab.

A BUTTON SOURCE OF PLASMA. Virgil G. McIntosh and Winston H. Bostick. Apr. 24, 1956. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The construction of a plasma source that projects deuterium and titanium ions and electrons at speeds up to 2×10^7 cm/sec is described. (auth)

4741

DYNAMICS OF IONIZED MEDIA. S. Gasiorowicz, M. Neuman, and R. J. Riddell, Jr. (Univ. of California, Berkeley). Phys. Rev. 101, 922-34(1956) Feb. 1.

The behavior of an ionized plasma is discussed in an approximation in which an individual particle is assumed to obey a Fokker-Planck equation, and where its interaction with the environment is incorporated in the coefficients of the partial differential equation. It is found that if the interaction of the test particle with the medium is divided into a "nearest neighbor" interaction (which manifests itself in "large-angle collisions") and an interaction with the rest of the medium, then the latter can be adequately treated by a perturbation method. If the nearest neighbor interaction is neglected, the coefficients of successive derivatives form a rapidly decreasing sequence, provided the average kinetic energy greatly exceeds the mean potential energy (which is usually the case). Within the framework of this approximation, the coefficients of damping (dynamical friction) and diffusion in velocity space are calculated and the higher (small) coefficients are estimated. (auth)

ELECTRONS

4742

SECONDARY EMISSION INDUCED BY VARIOUS MULTICHARGED POSITIVE IONS OF POTASSIUM. I. P. Flaks. Zhur. Tekh. Fiz. 25, 2463-6(1955) Dec. (In Russian)

Results are given for the investigation electron and ion secondary emission from unheated platinum targets, induced by K^+, K^{2+}, and K^{3+} ions accelerated to 1000 and 2000 v. The experiments showed that the γ and χ coefficients of secondary emission increase with the increased charges of primary

ions. The following values were obtained for γ and χ coefficients at ion energies of E_K = 200 Kev; $\gamma(K^+) = 4.04$; $\gamma(K^{2+}) = 4.63$; $\gamma(K^{3+}) = 5.62$; $\gamma(K^+) = 0.49$; $\gamma(K^{2+}) = 0.62$; $\gamma(K^{3+}) = 0.81$. In the range of kinetic energies studied, the $\gamma(E_k)$ curve was practically parallel for ions of various charges. The excess electron emission from multicharged ions was considered as the superposition of potential electron emission on the kinetic emission, proportional to the energy E_p and released during the ion neutralization on the surface of the target. (tr-auth)

4743

ELECTRON EMISSION INDUCED BY POSITIVE IONS OF ZINC, MERCURY, THALLIUM, AND LEAD. I. P. Flaks. Zhur. Tekh. Fiz. 25, 2467-76(1955) Dec. (In Russian)

A comparative study was made of secondary electron emission from cold platinum targets, induced by Zn^+, Zn^{2+}, and Zn^{3+}; Hg^+, Hg^{2+}, and Hg^{3+}, Tl^+, Tl^{2+}, Tl^{3+}, and Tl^{4+}; Pb^+, Pb^{2+}, Pb^{3+}, and Pb^{4+}, at identical kinetic energies. The data obtained for secondary electron emission qualitatively agree with the concept of superimposing on the kinetic emission the electrons of potential emission. The example with thallium showed that potential electron emission does not depend entirely on the kinetic energy of ions. (tr-auth)

4744

SCATTERING OF 200-KEV ELECTRONS IN GOLD. William G. Pettus, Henry G. Blosser, and Frank L. Hereford (Univ. of Virginia, Charlottesville). Phys. Rev. 101, 17-18(1956) Jan. 1.

The relative differential cross sections for scattering of 200-kev electrons by gold foils have been measured and compared to values computed from the Mott theory. The 70° to 150° angular range was covered. The data are in satisfactory agreement with theory and fail to show discrepancies previously reported. (auth)

4745

ANNIHILATION OF POSITRONS IN FL .. W. Kendall and Martin Deutsch (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 20-6(1956) Jan. 1.

The cross section for annihilation of positrons in flight has been measured for positron energies of 0.765, 1.02, 2.2, and 3.33 Mev. Positron energies were selected by means of a magnetic lens monochromator. A differential energy interval of about 0.1 Mev was defined by the pulse height from an anthracene crystal in which annihilation occurred. The annihilation radiation was detected in a scintillation counter biased to record only quanta above 0.51 Mev. The angular distribution of the annihilation radiation and the total annihilation cross section, at all energies, agrees with the theoretical values within the experimental accuracy, estimated to be about ±5%." (auth)

4746

ft VALUES AND L/K RATIOS FOR ORBITAL ELECTRON CAPTURE. Richard W. Hoff (Univ. of California Radiation Lab., Livermore) and John O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 101, 280-2(1956) Jan. 1.

The calculation of ft values for allowed and first forbidden orbital electron capture transitions is discussed. It is shown that ft values for $\Delta I = 1$, yes, orbital electron capture transitions, calculated using allowed f functions, can be compared directly with ft values for similar transitions involving beta particle emission. The L/K electron capture ratios for $\Delta I = 1$, yes, transitions are shown generally to be the same as for allowed transitions of similar energy for a given element. Comparison with experimentally measured L/K capture ratios is made. (auth)

4747

RECOIL BROADENING OF INTERNAL CONVERSION LINES ASSOCIATED WITH ALPHA DECAY. J. Burde and G. Cohen (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 5-6(1956) Jan. 1.

Internal conversion electrons emitted from recoiling nuclei may exhibit a significant broadening in the conversion line, especially for recoil nuclei associated with α decay. Line broadening and shifts arising from α recoil were observed for the L_I conversion electrons of the 40-kev transition in Tl^{208}. (B.J.H.)

4748

ON THE MATHEMATICAL CONNECTION BETWEEN THE CLASSICAL THEORIES OF THE ELECTRON OF FEYNMANN AND RZEWUSKI. G. M.Prosperi and C. Tosi (Univ. of Milan and National Inst. of Nuclear Physics, Milan). Nuovo cimento (10) 2, 1342-4(1955) Dec. (In Italian)

4749

POSITRON ELECTRON ANNIHILATION AND POSITRONIUM. I. G. M Lewis (Glasgow Univ., Scotland). Atomics 7, 33-7(1956) Jan.

Some significant features of the annihilation process are indicated. Annihilation of an electron and positron pair occurs chiefly by two or three quantum emission according as the total spin of the particles is 0 or 1 respectively. Both bound and unbound states of the positron electron system can occur. The bound states, constituting positronium, are of exceptional interest in view of the analogy with the hydrogen atom, and the fundamental nature of the two component particles. Positron and positronium lifetimes are discussed. (auth)

4750

THE DIFFUSION OF SLOW ELECTRONS IN DEUTERIUM. Barbara I. H. Hall (Univ. of Adelaide, Australia). Australian J. Phys. 8, 468-73(1955) Dec.

The agitational energies and drift velocities of slow electrons diffusing in deuterium are measured as a function of the ratio Z|p of the electric field strength Z to the gas pressure p. The lateral spread of the diffusing electron stream is measured, which enables Townsend's energy coefficient to be calculated. Drift velocities are measured using a magnetic deflection method. On the basis of the kinetic theory of gases these measurements are used to calculate values for the mean free path L of the electrons at unit pressure, the mean proportion η of the energy lost by an electron in a collision with a deuterium molecule, and the collisional cross section A of the molecules in collisions with the electrons. The values obtained are compared with those of Crompton and Sutton [Proc. Roy. Soc. A215,467 (1952)] for hydrogen. (auth)

4751

ANGULAR DISTRIBUTION OF PHOTOELECTRONS. Radha Raman Roy, Marie-Louise Goes, and Jean Compt. rend. 241, 1936-8(1955) Dec. 19. (In French)

The angular distribution of photoelectrons ejected aluminum by 1.17-and 1.33-Mev Co^{60} γ rays was studied. The experimental results were compared to Sauter's theory. (tr-auth)

GASES

4752 ISC-669

Ames Lab., Ames, Iowa.

IONIZATION DEFECT FOR ALPHA PARTICLES IN VARIOUS GASES. David W. Curtis and Glenn Miller. Aug. 1955. 50p. Contract W-7405-eng-82. $0.35(OTS).

The ionization produced by the Li^7 and α-particles from the reaction $B^{10}(n,\alpha)Li^7$ as they were stopped in argon, argon–nitrogen, and argon–carbon dioxide gas mixtures was measured. A gridded parallel-plate ionization chamber employing electron collection was used. Plutonium alpha particles were used for calibration and the ionization electron pulses were amplified and sorted with

an electronic pulse height analyzer. The neutron source was a 300-kev linear positive ion accelerator utilizing the D-D reaction. The neutrons were thermalized by blocks of paraffin stacked around the chamber. The thin boron film was made by evaporating boron enriched to 95% with B^{10} onto an aluminum backing. The gas mixtures were purified by continuous circulation over hot calcium–magnesium alloy. Results show the existence of a molecular defect for low energy alpha particles in the presence of polyatomic gases as suggested by the measurements of Herwig and Miller on fission fragments. The ionization defect of about 50 kev obtained for the Li recoils in argon gas is subject to considerable uncertainty due to conflicting evidence on the existence of ion recombination. This evidence would seem to indicate that there may be a fundamental difference between electron collection and total ion collection not as yet understood. Ionization defects of 51 ± 3 and 61 ± 3 kev were obtained for the Li recoils in argon plus nitrogen and in argon plus carbon dioxide respectively. The proton of each defect which may be attributed to the presence of a polyatomic gas can not be obtained from this experiment. (auth)

4753 WADC-TN-54-13

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.

GENERALIZED EQUATIONS AND PROCEDURES FOR THE CALCULATION OF DETONATION PARAMETERS. CASE I. IDEAL GASEOUS MIXTURES. Robert G. Dunn and Bernard T. Wolfson. Mar. 1956. 95p. Project Title: RAMJET TECHNOLOGY.

The classical equations of detonation in gaseous mixtures are presented in generalized form involving only dimensionless quantities. A comprehensive procedure is set forth for the calculation of detonative Mach numbers and associated parameters for any combustible gaseous mixture. The use of the method of calculation developed is illustrated by means of a sample calculation. For this purpose, calculations are presented for determination of detonation parameters for a stoichiometric mixture of H and O at an initial temperature and pressure of 18°C and atmospheric pressure, respectively. The calculation method developed is readily adaptable to computations by automatic computing machines as well as by manually-operated machines. Graphs of basic data are presented for use in the sample calculations, and it is believed that these data will find practical use in other applications as well. (auth)

Refer also to abstracts 4743 and 4852.

INSTRUMENTS

4754 AECU-3149

Dow Chemical Co. Rocky Flats Plant, Denver.

SERVO CONTROLLED LEAK FOR MASS SPECTROMETER. R. H. Roberts and K. B. Earnshaw. Jan. 17, 1955. 10p. Contract AT(29-1)-1106. (AMD-197).

The ion current in a mass spectrometer is maintained at a pre-determined constant value to within 1.1% by a servo system which controls the gas sample flow through a variable leak. The servo can recover from a 100% change in the ion current in approximately two minutes when the leak is located 26 inches from the ion source. The system consists of a variable leak, a leak drive unit, and a detector-amplifier. (auth)

4755 AERE-GP/M-190

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THEORY AND DESIGN OF AN ACOUSTIC PRESSURE GAUGE. W. Millar. Apr. 1956. 21p.

In the pressure range 10^{-2} to 10^{3} mm me. v, a number of well established types of gage are in use. Thes[illegible] manometers (mercury of oil), McLeod gages, Pirani gages, and comparison devices using a mechanical diaphragm. Each of these types has its own limitations in convenience, accuracy, or working range. A type of gage is proposed here in which these limitations could be less serious, and which will cover the whole of the above range. Operation of the instrument depends on the amplitude of received signal at the end of an "acoustic transmission line", which is simply a tube containing gas at the pressure to be measured. A simple form of the gage has already been constructed, which works well for air; design proposals are given for a gage of general applicability. (auth)

4756 AERE-GP/R-1800

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN EXPERIMENTAL STUDY OF THE S-BAND MULTITRON. K. Dolder. Dec. 15, 1955. 27p.

A detailed experimental study of the S band multitron is described. The results lead to an estimate of the performance of a proposed 200 Mc/s valve. A program of experiments at a frequency of 200 Mc/s is suggested. The characteristics of various secondary electron emitting surfaces in commercial vacuum systems are investigated, the properties of a surface suitable for use in a multitron are given. (auth)

4757 AERE-GP/R-1839

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A STABILIZED NEGATIVE E.H.T. SUPPLY FOR USE WITH AN ELECTRON MULTIPLIER. R. Hallett. Jan. 12, 1956. 10p.

A negative voltage supply has been designed which provides a voltage variable from 1 to 6 kv suitable for operating an electron multiplier when used as a positive ion detector in a mass spectrometer. It was designed with particular attention being paid to long and short term stability. The output voltage varies by 0.001% for a 17% change in mains voltage, and after a "warming up" time of one hour the output is constant to better than 1 part in 10,000. For loads taking up to a maximum of 0.5 ma at 1 kv, and up to a maximum of 2 ma at 5.75 kv the output impedance was less than 200 ohms, and the L.F. ripple was 10 mv at 5.75 kv. The complete E.H.T. unit is built up from an r-f oscillator unit. A portion of the E.H.T. is compared against a negative reference potential, the difference being amplified and used to control the screen of the r-f oscillator. The whole system provides stabilized 6 kv, any fraction of which may be chosen by a 20 position switch and applied to the external load. (auth)

4758 AWRE-0-6/55

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

A NEGATIVE FEED-BACK LINEAR MODULATOR. Beryl G. Bristow. Mar. 9, 1955. 13p.

A description is given of a linear modulator intended for testing discriminators. The necessary linearity has been obtained by the use of a negative feed-back loop incorporating an essentially linear discriminator of the counter type. (auth)

4759 DF-55A0400

General Electric Co., Schenectady, N. Y.

COOLING RATIO METER DEVELOPMENT. R. A. Raber. Sept. 28, 1955. 32p.

A static division circuit, using magnetic amplifiers, was developed for use in scheduling coolant flow for the SIR. A method using logarithmic shaping was chosen. Silicon

diodes and magnetic amplifiers were combined to provide a reliable circuit giving a meter indication of the ratio of two control system variables. No mechanical servos are required. The methods investigated are discussed and data are presented. (C.H.)

4760 IGR-TN/CA-251

Gt. Brit. Capenhurst Works, Ches., England.

A CAPACITANCE LEVEL GAUGE. D. F. Davidson. Sept. 13, 1955. 19p. (IGC-CPDC/R-122).

To cater for those cases where the normal float or pneumatic types of level gage cannot be used, an instrument was made using the principle of the capacitance change of a dielectric-coated metal rod when immersed in a conducting liquid. Possible circuits for capacitance measurement are considered. To enable multipoint measurements to be made remotely while retaining the advantages of a null balance rather than a direct deflection system, a double T-network transformer bridge is used which minimizes the effects of possible changes in connecting cables. A simple and reliable instrument results which can indicate level changes of less than a quarter of a centimeter. It is shown that almost any aqueous solution may be regarded as a conducting liquid in this application. Some solutions of very high conductivity, however, cause errors due to wetting of the surface of the dielectric which is polythene in this case. These errors could be reduced by using a higher frequency, a thinner dielectric or a non-wetting material for the dielectric such as PTFE. (auth)

4761 K-973(Pt. II)

Oak Ridge Gaseous Diffusion Plant, Tenn.

VIBRATION EFFECTS ON THE TAYLOR 206R PRESSURE TRANSMITTER. PART II. G. H. Job and J. A. Owen. June 19, 1956. 23p. Contract W-7405-eng-26. $0.20(OTS).

The results of a series of tests comparing the performance of a standard Taylor 206R Pressure Transmitter with one altered to overcome the undesirable effects of mechanical vibration are presented. The alterations consist of adding a dashpot, filled with Taylor XC-299 fluid, on the Sensing Lever; replacing the Overthrow Spring with a flexible metal strip; removing the capillary tubing and capacity cylinder in the secondary bellows assembly; and feeding the output signal directly into the secondary bellows. The performance of the altered transmitter is compared with that of the transmitter as originally designed. While the effects of vibration are not completely eliminated, they have been reduced by a factor of three at frequencies above 60 cps., and have been almost completely eliminated below 60 cps. In addition, the dynamic performance of the transmitter has been improved. It is recommended that all new transmitter installations be made with transmitters altered to reduce the effects of mechanical vibration. (auth)

4762 ORNL-2067

Oak Ridge National Lab., Tenn.

INSTRUMENTATION AND CONTROLS DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1956. May 3, 1956. 25p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Block and circuit diagrams and operational characteristics are given for instruments designed and constructed during the period. Included are a nonblocking counter amplifier, a gated pulse-train generator, the reactor-controls analog computer, a cathode-ray-tube output device for the ORACLE, an automatic gamma-ray decay recorder, an ultrasonic power amplifier and pickup, a vibration analyzer, Van de Graaff energy resolution and pulsed ion source instruments, mass spectrograph instruments, a thyratron power supply for electromagnetic stirring, a subminiature tube driver for glow-transfer tubes, and a 60-channel pulse-amplitude analyzer. (For preceding period see ORNL-1997.) (D.E.B.)

4763 OSR-TN-55-480

Cornell Univ., Ithaca, N. Y.

A HIGH RESOLUTION ELECTRON DIFFRACTION CAMERA FOR THE STUDY OF SURFACES IN AN ULTRA HIGH VACUUM. TECHNICAL REPORT NO. 4 [ON] THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE ATOMIC PHENOMENA OCCURRING ON AND NEAR THE SURFACES OF SOLIDS. Benjamin Siegel. Dec. 1, 1955. 51p. Project No. R-355-30-4. Contract AF 18(600)-674.

A special electron diffraction camera has been designed and built which will make it possible for the first time to examine clean surfaces in an ultra-high vacuum by high resolution electron diffraction. In this camera the electron beam and specimen are contained in a glass vacuum system which is baked-out and evacuated to a pressure of the order of 1×10^{-10} mm Hg. High resolution electron optics consisting of magnetic lenses are assembled around the outside of the glass column. The diffraction pattern comes to focus on a fluorescent screen inside the vacuum system and is recorded by photographing the pattern. It is to be expected that this new instrument will enable us to make significant advances in the study of surface structure. The apparatus also makes it possible to work with extremely well controlled atmospheres of different gases and with them to study surface adsorption and surface reactions. Plans are also outlined for the extension of this apparatus to microanalysis with an electron probe, a tool that should open up quantitative investigation of the surface constituents. (auth)

4764

ANISOTROPIC PROJECTOR. Robert B. Leighton (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 27, 79-82 (1956) Feb.

An optical projector having different magnifications, 5× and 50×, in two rectangular directions is described. Although the device is designed principally for rapid measurement of cloud-chamber track curvatures, it has been applied to various situations in which plane-to-plane imaging at constant magnification is desired. Simple plano-convex cylindrical lenses are used as the image-forming elements. These give quite satisfactory linearity and resolution at the maximum magnification. (auth)

4765

HIGH-SPEED LIGHT PULSE SHAPER USING A 5000 RPS ROTATING MIRROR. John B. Cladis, Clarence S. Jones, and Kenneth A. Wickersheim (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 83-7(1956) Feb.

A light pulse generator is described which utilizes a flash lamp and a 5000 revolutions per second rotating mirror. A variety of light pulse shapes can be produced having widths 1.16×10^{-9} to 10^{-6} second. (auth)

4766

CALIBRATION OF CURRENT INTEGRATORS FOR SMALL BEAM CURRENTS. Herbert N. Royden and David O. Caldwell (Univ. of California, Los Angeles). Rev. Sci. Instr. 27, 91-4(1956) Feb.

The current-time method of calibrating beam current integrators has been extended to give reliable calibrations for small currents when used with a feedback electrometer. The method described has given calibrations with absolute standard errors ranging from 0.2% at 10^{-10} amp to 0.3% at 10^{-11} amp. The equipment needed, including a precision 100-megohm resistance, is described, and some experimental difficulties in making calibrations for small currents are discussed. (auth)

4767

NEGATIVE HYDROGEN ION SOURCE. J. A. Phillips and J. L. Tuck (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 97-8(1956) Feb.

An r-f ion source of conventional type is shown to yield a current of 2.2 μa of negative hydrogen ions. This is accomplished by charge exchange of the positive ions emerging from the plasma with the neutral gas in the probe channel. The negative ion beam is well focused, and the performance of the source is 0.22 μa/cc at NTP/hour. The differential equations for the above charge exchange process are set down and solved, and found to be consistent with the observations to within an order of magnitude using published cross sections. The theory also predicts a sizable neutral beam (~60μa) of energy 2 to 3 kev. According to the equations and the published positive ion performance of these sources, many times larger negative hydrogen ion yields should be obtainable if required. (auth)

ISOTOPES

4768

CAESIUM-137 FOR INDUSTRIAL RADIOGRAPHY. R. S. Morgan (Armament Research and Development Establishment, London). Brit. J. Appl. Phys. 7, 25-8(1956) Jan.

The suitability of Cs^{137} as a γ-ray emitter for the radiography of steel has been investigated. An exposure chart has been produced and penetrameter-sensitivities calculated from experimentally determined broad-beam and narrow-beam absorption curves. The broad-beam curve is approximately linear for steel thicknesses exceeding 0·8 in., and from its slope, it would be expected that Cs^{137} would give radiographs similar in contrast to an X-ray tube operating at about 1·25 million volts peak. While Cs^{137} is a useful source for the examination of steel in the thickness range 1·5 to 4·0 in., below 1·5 in. Ir^{192} is superior. Within the range 1·5 to 3·0 in. the penetrameter sensitivity obtainable with Cs^{137} reaches its optimum value and is better than that obtainable with either Ir^{192} or Co^{60}. Protection data for sources of various strengths have been calculated from an experimentally determined attenuation curve for Pb. (auth)

4769

SLOW-NEUTRON CAPTURE RADIOISOTOPES ARRANGED BY HALF-LIFE. R. C. Geiger and R. C. Plumb (Aluminum Co. of America, New Kensington, Penna.). Nucleonics 14, No. 2, 30-1(1956) Feb.

A table listing in order of increasing half life the isotopes known to be produced by slow neutron capture, excluding transmutation reactions, is given. (D.E.B.)

4770

PRODUCTION OF P^{33} BY NEUTRON IRRADIATION OF SULFUR. Ingrid Fogelström and Torbjörn Westermark (Royal Inst. of Tech., Stockholm, Sweden). Nucleonics 14, No. 2, 62-5(1956) Feb.

The production of P^{33} by the reaction $S^{33}(n,p)P^{33}$ may be increased by taking advantage of the +0.52 Mev Q value, the Q value for the $S^{32}(n,p)P^{32}$ reaction being −0.93 Mev. By placing S in the area of higher thermal neutron flux, production is shifted toward P^{33}. The P^{33} yield as a function of distance from the reactor center is plotted. (D.E.B.)

ISOTOPE SEPARATION

4771

A MATHEMATICAL THEORY OF CHROMATOGRAPHY AND MODIFICATION OF THE DIFFUSION METHOD OF ISOTOPE SEPARATION. Prem Behari Mathur (Univ. of Allahabad, India). J. Sci. Ind. Research (India) 14B, 667-9 (1955) Dec.

A mathematical analysis of isotpic separation by the chromatographic process is presented. The separation occurs, it is theorized, as a result of different electrical potentials developed during diffusion. The nature of the medium, concentration and mass effects, and process variables are also discussed. (C.W.H.)

MASS SPECTROGRAPHY

4772 IGR-R/CA-164

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England. THE CONVERSION OF M.S.1 AND M.S.2. FOR THE ISOTOPIC ANALYSIS OF LITHIUM. J. Bishop and P. G. Bentley. Feb. 8, 1956. 34p.

Procedures are outlined for the isotopic analysis of Li by mass spectrometry. The precision of a single isotope ratio measurement is ±0.7% at 95% confidence level: separation factors for single measurements on a pair of samples can be measured to an accuracy of ±1% at 95% confidence level. A complete analysis of a single sample can be made in 3 hr. (C.W.H.)

MATHEMATICS

4773 NP-5974

Massachusetts Inst. of Tech., Cambridge. Digital Computer Lab.

ANALYSIS AND DESIGN OF A DIGITAL-TO-ANALOG DECODER (COMPUTER) (thesis). Robert Louis Walquist. May 28, 1951. 176p. (R-220).

4774 NYO-6485

New York Univ., New York. Atomic Energy Commission Computing Facility.

THE NYU OMNIFAX. Sandra Zucker. May 1, 1956. 51p. Contract AT(30-1)-1480. $9.30(ph OTS); $3.60(mf OTS).

The NYU Omnifax incorporates all frequently used service routines for the Univac computer. This routine contains all options from the Omnibus and has been expanded to include many new services. A description of the options of Omnifax is given, together with operating instructions for the routine. (auth)

4775

AN IMPROVED VARIATIONAL METHOD FOR THE SOLUTION OF THE ONE-GROUP DIFFUSION EQUATIONS. A. Hassitt (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 112-17 (1955) Dec.

A variational method is applied to the solution of one-group, many-region diffusion equations. Finite series expansions of the density functions are taken, and in consequence the boundary conditions at an interface between two regions cannot be satisfied exactly. The variational principle takes explicit recognition of this fact, and in consequence should converge more quickly than the usual analytic methods. The method is used in such a way that it is not necessary to solve a transcendental equation: the secular determinant is solved by an iteration method. As an example, the critical size of a cylindrical reactor, with a large enclosed cavity, is calculated. The variational solution of the problem agrees with the solution found by relaxation methods. The solution found by first-order perturbation theory, on the other hand, differs from these by 9%. (auth)

4776

ON GREEN'S FUNCTION FOR PHOTONS. N. M. Polievktov-Nikoladze. Doklady Akad. Nauk S.S.S.R. 105, 703-5(1955) Dec. 1. (In Russian)

The recently obtained expression for the renormalization

of the order of the functional Z derivative affords a new and simple method for establishing certain properties of Green's function for photons. (R.V.J.)

Refer also to abstracts 4822 and 4968.

MEASURING INSTRUMENTS AND TECHNIQUES

4777 AD-45247
Tracerlab, Inc., Boston.
NEUTRON SURVEY EQUIPMENT. Interim Engineering Report. (Phase II). R. Bersin. May 1954. 12p. Contract NObsr-57440.

Results are presented from tests on electronic circuits designed for use in a neutron survey instrument. (C.H.)

4778 AD-65280
Dugway Proving Ground, Tooele, Utah.
TEST OF THE MX-5, BETA-GAMMA SURVEY METER. RW Scientific Report No. 2. Damon Pace and Richard Vorwald. Feb. 24, 1954. 40p.

Several field trials were conducted to evaluate the performance of the MX-5 beta-gamma survey meter. Results are reported. (C.H.)

4779 AERE-EL/R-1753
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE RAPID DETECTION AND CONTINUOUS MONITORING OF RADIOACTIVE CONTAMINATION ON DUST IN LABORATORY AIR. K. E. G. Perry. Sept. 7,1955. 65p.

This report summarizes the work accomplished towards the development of instruments for the continuous monitoring and rapid detection of airborne particulate radioactive contamination. As the permissible level of Pu^{239} constitutes the most serious hazard the major part of the development has been towards the rapid detection of low levels of α activity, but β measuring instruments have also been developed. Instruments are described and illustrated. (auth)

4780 AWRE-O-33/55
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
"ABSOLUTE" BETA COUNTING WITH 2B2 AND EHM2 END-WINDOW G. M. TUBES. J. L. Bunce. Sept. 15, 1955. 26p.

Techniques are described for the improvement of counting accuracy of low energy β emitters when 2B2 and EHM2 end-window Geiger-Mueller tubes are used. Methods are outlined for determining the absolute disintegration rate of a source, and results are included from an evaluation of the contribution of back scattering by the material supporting the source, the effect of the mass of the source in causing both scattering and absorption of β particles, and the effect of the source support structure and walls of the housing in scattering β particles into the counter. Possible errors in geometry are reviewed. (C.H.)

4781 CEA-370
France. Commissariat à l'Energie Atomique, Paris.
REALISATION D'UN SPECTROMETRE β SOLEMOIDAL ET D'UN DOUBLE SPECTROMETRE β A COINCIDENCE (theses). (Construction of Solenoidal β Spectrometer and a Double Coincidence β Spectrometer (thesis)). Jean Moreau. 1955. 84p.

Detailed descriptions are given of a β spectrometer using a uniform magnetic field and of a double coincidence β spectrometer. Included are discussions of the theory of focusing in a uniform magnetic field, coincidence spectrometry, a spectrometer whose magnetic field varies as 1/r, the applications of double spectrometers, and a review of the theory of β radioactivity. Experimental results for Sb^{124}, Sb^{125}, and Sb^{122} are included. (B.J.H.)

4782 CEA-482
France. Commissariat à L'Énergie Atomique, Paris.
SUR LA DETERMINATION DE QUELQUES CARACTERISTIQUES FONDAMENTALES DE COMPTEURS DE GEIGER-MULLER. APPLICATIONS A L'ETUDE DES PARTICULES RETARDEES DES GERBES ATMOSPHERIQUES DU RAYONNEMENT COSMIQUE. (theses). (On the Determination of Some Fundamental Characteristics of Geiger-Mueller Counters. Applications to the Study of Delayed Particles in Atmospheric Cosmic Ray Showers (thesis)). E. Picard. 1955. 67p.

The operating principles of Geiger counters are reviewed, and the discharge mechanism of a self-quenching counter is discussed. The motion of primary electrons in the counters is also discussed, and expressions are derived for the latent induction time for the counter. The use of G-M counters in coincidence circuits is briefly surveyed. The movement of positive ions in the counter is reviewed in some detail, and expressions are included for counter dead time. The delayed particles in cosmic ray showers in air were studied by G-M counters in coincidence. The mean life of μ mesons in the showers was found to be 2.10 ± 0.15 μs. (B.J.H.)

4783 CEA-483
France. Commissariat à l'Énergie Atomique, Paris.
CONTRIBUTION A L'ETUDE DE LA SPECTROMETRIE α PAR LA CHAMBRE D'IONISATION A IMPULSION APPLICATION A L'ETUDE DE LA STRUCTURE FINE DU RAYONNEMENT DE QUELQUES NOYAUX LOURDS (theses). (Contribution to the Study of α Spectrometry by Pulse Type Ionization Chambers. Application to the Study of the Fine Structure of Radiation from Some Heavy Nuclei (thesis)). Georges Valladgs. 1955. 75p.

Design details are given for an ionization chamber, and descriptions are included of the associated electronic equipment. The energy resolution of an α spectrometer using the ionization chamber was studied, and the possibilities of detecting low-intensity fine structure radiation are considered. A study was made of the fine structure of the α emission from Th^{230}, U^{234}, and U^{238}. (B.J.H.)

4784 DP-138
Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.
APPLICATIONS OF A SMALL, WIDE-RANGE GAMMA DETECTOR. A. C. Lapsley and R. T. Nowak. Oct. 1955. 16p. Contract AT(07-2)-1. $0.20(OTS).

A small γ probe operable between 100 mr/hr and 10^3 r/hr was built to measure γ ray intensities near a large nonuniform source or in a large nonuniform field. The sensitive element, a thallium-activated sodium iodide crystal, is observed by a phototube. Four applications of the unit are described. (auth)

4785 IGO-AM/W-34
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF α AND β ACTIVITIES IN MUSSELS AND OTHER INVERTEBRATES. Celia J. Banks. Apr. 16, 1956. 3p.

4786 IGO-AM/W-35
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF α AND β ACTIVITIES IN VEGETATION, ROOTS, SEAWEED, SOIL, SEABED SLUDGE, SEASHORE SAND, SILT AND RIVER MUD. Celia J. Banks. Apr. 12, 1956. 4p.

4787 IGO-AM/W-37
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
COUNTING THE TOTAL α ACTIVITY OF GRANULAR MATERIAL AT "INFINITE DEPTH" USING AN α SCINTILLATION COUNTER TYPE 1093. L. P. O'Connor. Apr. 17, 1956. 4p.

4788 IGR-TN/W-264

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

A LOW BACKGROUND β SENSITIVE PHOSPHOR FOR BURST CARTRIDGE DETECTION IN THE CALDER REACTORS. D. J. Skillings. Oct. 26, 1955. 17p. (IGC-TRDC/P-129).

The effect of temperatures of up to 40°C on the counting efficiency of three types of β-sensitive organic plastic phosphors has been measured. Of those considered, tetraphenyl butadiene in polystyrene was found to be the most efficient, and the least affected by temperature changes. A technique has been developed for making a low background composite phosphor, by shrink-fitting a cylinder of the phosphor into a perspex light guide. An increase of signal/background ratio by a factor of 2.5, without loss in sensitivity, is attainable in a design for β energies similar in value to those of the daughters of gaseous fission products. (auth)

4789 JENER-39

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

A FAST NEUTRON DETECTOR. K. Skarsväg. Dec. 1955. 8p.

A fast neutron detector of the Hornyak type, with and without light guides, is described and the efficiency of the detector discussed. (auth)

4790 K-1286

Oak Ridge Gaseous Diffusion Plant, Tenn.

RADIATION PROBES FOR ALPHA MONITORING. R. C. Smith. June 13, 1956. 77p. Contract W-7405-eng-26. $0.45(OTS).

Five different forms of air proportional counter probes developed for detection and measurement of alpha radiation for use with an amplifier and high voltage supply panel are described. These probes included designs for use in monitoring the hands and the bottoms of the shoes of personnel, a small surface probe, a probe for monitoring the inside corners of equipment, and a long probe for use in detecting radiation on clothing. The development of an anode or collector system and the special insulators used in these probes is discussed. The tests leading to the final probe designs are described. A description of a pocket proportional alpha survey meter is included. The report also describes a voltage regulator which was incorporated as a part of each probe. By the use of this regulator, several probes of different optimum operating voltages can be supplied from a single high voltage source without reducing the sensitivity of any of the probes. (auth)

4791 LA-1982

Los Alamos Scientific Lab., N. Mex.

CALIBRATION OF A MOCK FISSION NEUTRON SOURCE BY INDIUM RESONANCE MAPPING OF THE STANDARD GRAPHITE PILE. C. J. McDole, E. R. Graves, and R. W. Davis. Dec. 1955. 15p. Contract W-7405-eng-36. $0.20(OTS).

By the integral comparison method, the strength of mock fission neutron source MF23 was determined in terms of the strength of the standard Ra–Be neutron source number 44. In this laboratory, mock fission sources have been calibrated heretofore by comparison of thermal activity in the standard graphite pile with that of a Ra–Be source. This method is much faster and allows much greater statistical accuracy for weak sources. However, the thermal distribution of a mock fission source differs from that of a Ra–Be source because of the neutron energy spectrum difference. This effect had been estimated to lead to a 5% correction on the relative source strength as determined by thermal activity comparisons. The present experiment was designed to calibrate the mock fission source by integrating the indium resonance activity in order to determine precisely the spectrum influence on the thermal comparison and derive constants to be used with thermal comparisons. Although MF23 blew up before the experiment was as complete as planned, the data obtained were adequate to combine with existing thermal measurements on other MF sources to derive a satisfactory set of constants for use with the thermal comparison methods. (auth)

4792 NP-5973

Naval Medical Research Inst., Bethesda, Md.

A RAPID READING AND HANDLING SYSTEM FOR MINIATURE CONDENSER TYPE IONIZATION CHAMBERS. Memorandum Report 56-5. J. W. Duckworth. Aug. 4, 1955. 10p. Project NM 000 018.07.

Based on recognized physical principles, a semi-automatic production line technique was devised for reading and handling miniature ionization chambers with greatly reduced time and manpower requirements. Good flexibility in the choice of chamber charging voltage, and thus of exposure range, was permitted by the use of variable charge-splitting condensers and multi-range electrometers. A method for simultaneously charging 2,000 chambers was also developed. Such automation effectively eliminated many human errors common to individual chamber handling techniques. (auth)

4793 RFP-61

Dow Chemical Co. Rocky Flats Plant, Denver.

SCINTILLATION GAMMA ALARM. H. L. Miller. May 11, 1955. 24p. Contract AT(29-1)-1106. $0.25(OTS).

A simple device has been developed for indicating the strength of γ radiation fields. The radiation is detected by a sodium iodide phosphor and photomultiplier combination. A relay-meter operated directly from the photomultiplier anode is used both as an indicator and to operate external alarm circuits. The alarm is usually set to respond to a steady field of 12 mr/hr, although considerably greater sensitivity can be obtained. Sensitivity to pulses of radiation is decreased as pulse duration decreases. (auth)

4794 UR-439

Rochester, N. Y. Univ. Atomic Energy Project.

THE MEASUREMENT OF DIFFUSE REFLECTANCE OF PIG SKIN, TITANIUM DIOXIDE PAINT AND INDIA INK; THE TRANSMITTANCE OF TITANIUM DIOXIDE AND INDIA INK. L. J. Krolak. Apr. 9, 1956. 23p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Diffuse reflectance measurements for thermal radiation were made on the bare skin of Chester White pigs and also on TiO_2 paint and India ink painted on the skin. The wavelength region from 0.4 μ to 2.6 μ was investigated. Transmittance studies were also made on these coatings of TiO_2 and India ink in the same wavelength range. For this study it was necessary to construct a spherical type integrating reflectometer which was an improvement over previous equipment. (auth)

4795 WADC-TR-54-519(Pt. II)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AUTOMATIC DATA REDUCTION. PART II. A CATALOG OF DEVICES USEFUL IN AUTOMATIC DATA REDUCTION. Robert S. Hollitch and Albert K. Hawkes. Nov. 1954. 78p. Project title: SYSTEM DYNAMICS RESEARCH AND ANALYSIS. Contract AF33(616)-2573. (AD-50074).

The catalog prepared serves the purpose of summarizing the characteristics of devices useful in automatic data recording and reduction systems which are commercially available or under development. Included are analog voltage-to-digital converters, shaft position digitizers,

digital plotters, digital to analog converters, digital voltmeters, and special tape recorders. (auth)

4796 WCRT-TN-54-245

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

NUCLEAR RADIATION ENERGY SPECTROMETER—GRAY WEDGE METHOD. Ralph E. Woodard. Dec. 1954. 17p. (AD-69002).

A literature search and preliminary study were made to evaluate existing laboratory equipment for measuring the γ-ray spectrum of radioisotopes. An experimental gray-wedge pulse-height analyzer was constructed which should provide a rapid, accurate, and economical method for data collection. The gray wedge is used for photographing the traces; the wedge is made from neutral-density filter glass, Schott NG.4 or NG.5. The instrument is adapted for rapid, energy-level determinations of γ emitters and for measurements of short-lived isotopes. Energy spectra of low-activity sources can be recorded by long-time exposures. Energy spectra of more than one radioisotope can be determined. (auth)

4797

SMALL SIZE BETA SPECTROMETER. S. A. Baranov and R. M. Polevoĭ. Zhur. Tekh. Fiz. 25, 2535-6(1955) Dec. (In Russian)

A description is given of a small size beta spectrometer with a uniform field, focusing a first order electron beam in a direction perpendicular to the field. The spectrometer was used to identify radioactive isotopes from beta spectra. The electron and positron spectra up to 5 Mev were taken simultaneously on the spectrometer. The principle of construction is simple and the results are accurate. The weight of the magnet and chamber is 75 kg. The magnetic coils are supplied from 18 v. batteries with 15 amp. maximum. (R.V.J.)

4798

ELECTRON CAMERA OF SIMPLE DESIGN. M. A. Rumsh. Zhur. Tekh. Fiz. 25, 2556-64(1955) Dec. (In Russian)

A simplified design of an electron camera is offered with detailed description of the simplified methods of construction. (R.V.J.)

4799

THERMAL GRADIENT EFFECT IN PROPORTIONAL COUNTERS. C. W. McCutchen (Cavendish Lab., Cambridge, England). Rev. Sci. Instr. 27, 106(1956) Feb.

The effect of a thermal gradient and corresponding density gradient on the multiplication of the filling gas was studied. Experimental evidence substantiates the theoretical prediction that this effect will be 1 to 2% per °C. (D.E.B.)

4800

NEUTRON SENSITIVE ELECTRON MULTIPLIER TUBES. G. F. Erickson and S. G. Kaufmann (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 107-8(1956) Feb.

Secondary electron emission from surfaces bombarded with heavy particles has been investigated as a means of detecting neutrons. Emission produced by the α particles from the B^{10} (n,α) reaction was studied as means for neutron detection in electron multiplier tubes. A boron film was baked on the glass cover of 6292 photo-tubes for these studies. Experimental preparations are given, and results are plotted. (D.E.B.)

4801

ELECTRON MULTIPLIERS IN MASS SPECTROMETRY; EFFECT OF MOLECULAR STRUCTURE. Henry R. Stanton, William A. Chupka, and Mark G. Inghram (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 109(1956) Feb.

The effect of an ion's structure on the number of secondary electrons it produces is investigated. Results for Hg^{204+} and $C_{14}H_{10}^{+}$ (mass 178) are given. The average pulse height for $C_{14}H_{10}^{+}$ is 2.3 times that of Hg^{204+} for the same kinetic energy. (K.S.)

4802

WATERPROOF PAINT FOR CERENKOV AND SCINTILLATION COUNTERS. J. Harris and K. W. Ogilvie (National Research Council, Ottawa, Canada). Rev. Sci. Instr. 27, 113 (1956) Feb.

The reflectance of a flat white paint made from zinc oxide, alkyd resin, and mineral spirits, as a reflector in Cherenkov and scintillation detectors, is given. The paint is waterproof and easier to use than the usual MgO powder. (D.E.B.)

4803

APPLICATION OF HIGH MAGNETIC FIELDS TO NUCLEAR TRACK ANALYSIS AND SOLID STATE RESEARCH. H. P. Furth and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Nuovo cimento (10) 2, 1350-2(1955) Dec. (In English)

4804

ON LARGE SCINTILLATION COUNTERS. D. Brini, L. Peli, O. Rimondi, and P. Veronesi (Istituto di Fisica dell' Università, Bologna). Nuovo cimento (10) 2, Suppl. No. 4, 1048-74(1955).

A detailed study of the causes of nonuniformity in counters with large scintillators is made to establish criteria for the resolution of particular problems. The parallelipiped shape with transparent walls and two photosensitive surfaces appears to give the best counting arrangement. (D.E.B.)

4805

PHYSICAL REQUIREMENTS OF BEAM DEFINING SYSTEMS FOR MEDIUM DISTANCE TELETHERAPY UNITS. J. L. Haybittle (Addenbrooke's Hospital, Cambridge, England). Acta Radiol. 44, 505-20(1955) Dec.

The physical requirements of beam defining systems for teletherapy units working at Source-skin-distances from 20 to 40 cm are discussed with special reference to sources of Cs^{137} and Co^{60}. The results of theoretic calculations and experimental measurements of surface ionisation ratio (S. I. R.) under a number of different conditions are presented for the γ-rays from Ir^{192}, radium and Co^{60}, and it is possible from these to predict the S.I.R. to be expected in any actual unit. The effect upon the S.I.R. of extension cones to aid field positioning has been investigated and measurements show that in all cases their presence increases the S.I.R. and some other type of aid is preferable. The influence of source size upon the thickness of the shielding of applicators and diaphragms is examined and discussed. (auth)

4806

A HIGH TRANSMISSION BETA-RAY SPECTROMETER OF THE DOUBLE FOCUSING TYPE. E. Arbman and N. Svartholm. Arkiv Fysik 10, No. 1, 1-18(1956).

A detailed discussion is given of a high-transmission β spectrometer utilizing the double-focusing property of inhomogeneous magnetic fields. Included are complete diagrams of the spectrometer and discussions of its field distribution, focusing properties, and calibration. Some of the results obtained with this spectrometer are reported, including the β spectrum of P^{32}, the positron spectrum of Fe^{52}, and the conversion lines from Pb and Tl isotopes. (B.J.H.)

4807

INVESTIGATION OF THE FOCUSING PROPERTIES OF A DOUBLE DIRECTIONAL FOCUSING MAGNETIC SPECTROMETER WITH CONICAL POLE SURFACES. R. Pauli. Arkiv Fysik 10, No. 2, 175-85(1956).

4808

TISSUE-EQUIVALENT IONIZATION CHAMBERS. Harald H. Rossi and G. Failla (Columbia Univ., New York). Nucleonics 14, No. 2, 32-7(1956) Feb.

When radiations of different biological effectiveness occur simultaneously, the biological effect to be expected will depend not only on the total dose, but on the relative proportions of components of high and low specific ionization. To assess the contributions to the total dose according to specific ionization, the composition of chamber construction materials may be modified. Formulas for tissue-equivalent liquids, gases, and solids, construction techniques, filling procedures, and performance data for tissue-equivalent ionization chambers are given. (D.E.B.)

4809

TWO WAYS TO ESTIMATE THYROID DOSE FROM RADIOIODINE IN FALLOUT. Gordon M. Dunning (U. S. Atomic Energy Commission, Washington, D. C.). Nucleonics 14, No. 2, 38-41(1956) Feb.

Thyroid doses from fall-out iodine isotopes are used to exemplify the difficulty in making fall-out dosage determinations. Precise calculation of the iodine dose is made difficult by uncertainties of the percent of body intake which reaches the thyroid, and the amount and decay of tellurium taken in with the iodine. These difficulties are discussed and a sample dose calculation is made which minimizes these sources of error. (D.E.B.)

4810

DURABLE WHITE COATING IMPROVES LIQUID SCINTILLATION COUNTERS. D. E. Bannerman and R. J. Lanter (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 2, 60-1(1956) Feb.

Sensitivity increases in liquid scintillation counters were gained through the use of a TiO_2-lacquer container-wall coating. A coating method which prevents peeling is given. (D.E.B.

4811

A SIMPLE METHOD TO DETERMINE THE DEAD TIME OF A GEIGER COUNTER. Louis Danguy. Physica 21, 988-9 (1955) Dec. (In French).

4812

PRINCIPLES AND TECHNIQUES OF MIXED RADIATION DOSIMETRY. APPLICATION TO ACUTE LETHALITY STUDIES OF MICE WITH THE CYCLOTRON. G. S. Hurst, W. A. Mills, F. P. Conte, and A. C. Upton (Oak Ridge National Lab., Tenn.). Radiation Research 4, 49-64(1956) Jan.

It is shown that for a typical biological experiment, in which a cyclotron with an internal target was used as a radiation source, the fast neutron dose as measured with a proportional counter dosimeter and threshold detectors agreed within 10%. Furthermore, the readings of the Failla-Rossi tissue-equivalent chamber, when corrected for γ-ray response by exposing photographic film in the Bureau of Standards film packet, gave approximately the same neutron dose. A difficulty in making this correction arose from the fact that the γ-ray film, like all other known γ-ray dosimeters, has a neutron response which is poorly known. The threshold detector method of fast neutron dosimetry has an important advantage over the methods in which the dose is measured directly. This advantage is that the dose distribution versus energy obtained from the threshold detector data allows a simple calculation of the distribution of absorbed energy versus linear energy transfer to be made. (auth)

4813

VISIBLE LIGHT EMISSION ACCOMPANYING GEIGER DISCHARGE. Fumio Yamasaki and Masaharu Okano. J. Sci. Research Inst. (Tokyo) 48, 13-19(1954) Mar.

Visible light emission accompanying the Geiger discharge was measured using a photomultiplier tube as light detector. Intensity of light was measured as a function of applied high voltage for the alcohol-quenched and bromine-quenched Geiger-Muller counters. By measuring the time interval of flashes observed through two windows by the delayed coincidence method, the spread velocity of flashes along the counter length was determined. It was in accord with the velocity of spread of Geiger discharge along the anode wire for alcohol-quenched counter. In bromine-quenched counters it had values of the order of 10^8 cm/sec even in the counting region. (auth)

4814

ABSOLUTE CALIBRATION OF THE NATIONAL BUREAU OF STANDARDS PHOTONEUTRON STANDARD. II. ABSORPTION IN MANGANESE SULFATE. James De Juren and Jack Chin. J. Research Natl. Bur. Standards 55, 311-16 (1955) Dec.

An absolute method of calibrating a neutron source by determining the neutron absorption rate in a $MnSO_4$ bath is described. In this method slightly more than one liter of solution from the bath is irradiated in a strong neutron flux. The absolute activity of Mn in an aliquot of this activated solution is determined with a 4π flow proportional counter. Concurrently, one liter of this solution is added to the inactive bath and after stirring, the counting rate is measured with a dip counter. As the number of radioactive Mn nuclei contained in the liter is obtained from the aliquot activity, the dip counter is calibrated for a known Mn activity. Then the bath is irradiated by the source and the dip counting rate at saturation yields the neutron capture rate by the Mn. From a knowledge of the neutron capture cross sections and the $MnSO_4$ concentration, the fraction of neutrons captured by Mn is determined. As a result, the total neutron capture rate in the bath at saturation is obtained. A value of $Q = 1.25_0 \times 10^6$ neutrons per second was obtained for the NBS source (1954). The standard error is $\pm 2\%$. (auth)

4815

LOGARITHMIC SCALE PULSE INTEGRATOR FOR DISINTEGRATION CURVES OF RADIOACTIVE SUBSTANCES. Kurt Franz. Publ. com. nacl. energia atomica (Buenos Aires), Ser. fís. 1, No. 6, 101-14(1955). (In Spanish).

Circuit diagrams and pulse forms are given for a pulse integrator intended to measure the activity of substances which disintegrate with half lives from several seconds to hundreds of hours. (B.J.H.)

4816

THE DEKATRON IN NUCLEAR INSTRUMENTATION. L. C. Burnett and M. Hawkes. Atomics 6, 283-90(1955) Sept.

Refer also to abstracts 4542 and 5002.

MESONS

4817 UCRL-3368

California. Univ., Berkeley. Radiation Lab.

THE MASSES OF IDENTIFIED POSITIVE HEAVY MESONS (thesis). James Ray Peterson. Apr. 5, 1956. 58p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

The charged secondary particles from all presently known decay modes of K^+ mesons have been identified, and the masses of the primaries measured by the momentum-range method. More than 2000 K mesons were found in a rather large stack of nuclear emulsion after its exposure, behind the strong-focusing magnetic spectrometer at the Bevatron, to a target plunged into the 6.2-Bev circulating proton beam. The means K-meson momentum at the stack was 360 Mev/c, and the proper time of flight was 1.4×10^{-8} sec. The masses of 263 systematically selected K mesons were measured, and the averages for the various decay modes are: $M_{\tau+\tau'} = 966.6 \pm 1.9\ m_e$, $M_{K_{\pi 2}} = 966.7 \pm 2.0\ m_e$, $M_{K_{\mu 2}} = 967.2 \pm 2.2 m_e$, $M_{K_{\mu 3}} = 967.6 \pm 6.3\ m_e$, $M_{K_{\beta 3}} = 964 \pm 10\ m_e$. The standard errors indi-

cated apply to the relative masses; the uncertainties on the absolute masses are slightly larger. Various corrections are described. The results are discussed in the light of recent ideas concerning heavy-meson characteristics. (auth)

4818 UCRL-3383

California. Univ., Berkeley. Radiation Lab.

Z DEPENDENCE OF POSITIVE-PION PRODUCTION BY 335-MEV BREMSSTRAHLUNG AND 340-MEV PROTONS (thesis). William L. Imhof. Apr. 19, 1956. 45p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The relative yields of π^+ mesons from H, Li, Be, B^{10}, B^{11}, C, Al, Cu, Ag, and Pb produced by 225-Mev bremsstrahlung and 340-Mev protons were measured at 135° to the beam line. The pions were identified in a plastic scintillator telescope by the π-μ decay method. At the Berkeley synchrotron the relative π^+ yields for these elements were measured at seven different pion energies, ranging from 12 to 65 Mev. The results showed little variation of the A dependence with pion energy. By the model of Brueckner, Serber, and Watson the mean free path for mesons in nuclear matter is less than $3r_0$ at all meson energies. The yields of 36- and 63-Mev mesons were measured at the 184-inch cyclotron. The pion-production efficiency dropped off faster with increasing A under proton bombardment than under gamma bombardment. These results compared well with the expressions given by Gasiorowicz for the effect of the energy degeneration of the incident protons in nuclear matter. (auth)

4819

SPECTRA OF π MESSON AND PROTON FORMATION IN GRAPHITE. N. M. Kocharyan, G. S. Saskyan, M. T. Alvazyan, Z. A. Kirakosyan, and A. S. Aleksanyan. (Armenian Inst. of Physics). Invest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 508-14(1955) Sept.–Oct. (In Russian)

The measurements were made with a magnetic spectrometer with the magnetic field kept constant at 7100 Oe. A detailed scheme of the spectrometer, the tables of 308 observed negative π mesons at their energies and the experimental data of 1089 observed protons with energies $E > 0.05$ Bev generated by the neutrons in the layer of 7.3 g/cm^2 graphite + 0.54 g/cm^2 copper (counter walls) are given. The proton spectrum in the impulses of $p < 2$Bev/c and the energy spectra of protons and negative π mesons generated on graphite absorber are also shown. (R.V.J.)

4820

FORMATION OF NEUTRAL MESONS BY HIGH-ENERGY NUCLEONS. M. S. Kozodaev, A. A. Tyapkin, Yu. D. Bayukov, A. A. Markov, and Yu. D. Prokoshkin. (Inst. of Nuclear Problems). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 589-603(1955) Sept.-Oct. (In Russian)

A general review and corrective data for π^0 formation are presented. 30 references. (R.V.J.)

4821

PHOTOFORMATION OF CHARGED π MESONS FROM HYDROGEN AND DEUTERIUM. M. I. Adamovich, G. V. Kuz'micheva, V. G. Larionova, and S. P. Kharlamov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 606(1955) Sept.–Oct. (In Russian)

Experimental studies indicated a considerable electrical dipolar absorption of γ quanta at the threshold of π^+-meson photo formation from hydrogen. In the case of π^--meson photo formation in deuterium, an interaction spin was observed causing a shift in the spin of the nucleon system. The probability limit of the spin shift of the nucleon system near the threshold of π-meson formation was 40%. (R.V.J.)

4822

ON THE RENORMALIZATION IN MESON DYNAMICS. A. M. Brodskiĭ. Doklady Akad. Nauk S.S.S.R. 105, 939-42 (1955) Dec. 11. (In Russian)

The renormalization invariables of the reciprocity constant and the mass in meson dynamics were calculated. The calculations were based on Shwinger's values developed for quantum electrodynamics. (R.V.J.)

4823

ON THE ANOMALOUS SCATTERING OF μ-MESONS. G. N. Fowler (Univ. of Manchester, England). Nuclear Phys. 1, No 2, 119-24(1956).

The inelastic scattering of μ mesons with excitation of the "giant" nuclear dipole resonance and its influence on the large angle scattering of μ mesons are discussed. It is concluded that the Williams virtual photon method in its original form is not applicable to problems of this kind and that the excitation of "giant" dipole resonances is unable to explain the observed large angle scattering. (auth)

4824

ON THE ANOMALOUS MAGNETIC MOMENT OF THE μ-MESON. G. N. Fowler (Univ. of Manchester, England). Nuclear Phys. 1, No. 2, 125-32(1956).

A discussion is given of various phenomena involving μ mesons, especially bremsstrahlung and pair production, in which an anomalous magnetic moment of the meson should be important, taking into account finite meson size effects in a relativistic way. It is found that the empirical evidence rules out the existence of an anomalous magnetic moment of any significance for the μ meson. (auth)

4825

ON THE PRODUCTION OF MESONS IN HYDROGEN AND CARBON ABOVE 10 BEV. Y. Watase, K. Suga, Y. Tanaka, and S. Mitani (Osaka Univ., Japan). Nuovo cimento (10) 2, 1183-1201(1955) Dec. (In English)

Penetrating showers from hydrogen and carbon (average energy about 30 Bev) have been studied by CH_2–C subtraction method with a counter hodoscope at mountain altitude. The cross section for meson production in hydrogen was found to be 67 ± 25 mb and that for multiple production appears to be at least about 70% of this value. No difference in the cross-sections for p-p and n-p collisions was observed. The angular distribution of the charged shower secondaries seems to show a forward peak in the p-p collisions, and this tendency may be interpreted by the hypothesis that the incident nucleon is emitted into a rather sharp forward cone in the c.m. system, at least when the multiplicity is small. (auth)

4826

ON THE PRODUCTION OF π MESONS IN HEAVY NUCLEI USING ENERGETIC PRIMARY NUCLEONS. G. Costa and G. Lanza (Univ. of Padua and National Inst. of Nuclear Physics, Padua). Nuovo cimento (10) 2, 1211-23(1955) Dec. (In Italian)

The production of π mesons in Al, Ag and Pb has been studied, assuming the independent particles nuclear model, and treating the behavior of the pions in the nuclei as a succession of single collisions from their creation, at any point in a nucleus, until their emission or absorption. The total and differential scattering cross sections, partially derived from machine data, and partially deduced by the charge independence principle and the detailed balancing method were used. Due to the scarcity of precise data on the absorption cross section, three different curves were assumed. Owing to the complexity of the phenomena, a Montecarlo calculation was made building two series of three-dimensional models, respectively for pions with an initial energy of 100 and of 200 Mev (energy at the creation inside the nucleus). The lack of precise indications on the pion production spectrum makes the results not directly

comparable with experimental data, except those which are found to be independent enough on the initial energy. This is the case of the total production cross-section of the pions, which increases with the atomic number and shows a tendency to saturation, and of the angular distributions which indicate a maximum in the forward direction and another between about 100 and 120 degrees. No one of these results seems to be dependent in a sensible way on the type of assumed absorption. (auth)

4827

CONSIDERATION OF THE DECAYS OF π AND K MESONS INTO LIGHT FERMIONS. F. Duimio (Univ. of Milan and National Inst. of Nuclear Physics, Milan). Nuovo cimento (10) 2, 1308-16(1955) Dec. (In Italian)

Information is deduced on the possibility of a general scheme of interactions between the elementary particles, with a qualitative analysis of some characteristic features of π and K decays into light fermions. The conclusions seem to be in agreement with a scheme proposed by Dallaporta and Gell-Mann. (auth)

4828

CLASSIFICATION OF THE EISENBERG AND SIMILAR EVENTS. R. G. Sachs and S. B. Treiman (Princeton Univ., N. J.). Nuovo cimento (10) 2, 1331-3(1955) Dec. (In English)

The interpretation of the decay of a metastable particle into a negative K meson is discussed. An interpretation in terms of a super K meson, K_s, whose isotopic spin is $\frac{1}{2}$ is suggested. The particle can decay slowly according to the scheme $K_s \rightarrow K_2 + \pi$. (B.J.H.)

4829

ANELASTIC SCATTERING OF π-MESONS ON CARBON. M. Della Corte, T. F. Fazzini, and A. M. Sona (Univ. of Arcetri, Firenze). Nuovo cimento (10) 2, 1345-9(1955) Dec. (In English)

Ilford G5 plates were exposed to a $\pi^{\pm}$-meson beam of energy between 60 and 125 Mev. Preliminary results are reported on inelastic scattering events with the emission of three low-energy particles. (B.J.H.)

4830

EFFECT OF THE FAILURE OF ISOTOPIC SPIN CONSERVATION ON THE PION-NUCLEON S WAVES. H. P. Noyes (Univ. of Rochester, N. Y.). Phys. Rev. 101, 320-3(1956) Jan. 1.

The charge-dependent effects of the $\pi^- - \pi^0$ mass difference, the Coulomb interaction, and the $\pi^- + p \rightarrow \gamma + n$ radiative transition are calculated phenomenologically using a charge-independent potential model for the pion-nucleon nuclear S-state interaction. It is found that the charge-exchange S-wave-scattering is little affected but that the transition rate for a bound π^- meson (Panofsky effect) is suppressed about 10%, removing the discrepancy between the difference in scattering lengths as calculated from scattering and from the Panofsky effect. However, it is also found that there can be 25% corrections to the π^- elastic scattering amplitude of either sign, making the precise analysis of low-energy π^- elastic scattering experiments difficult. (auth)

4831

EXPERIMENTS WITH SLOW K MESONS IN DEUTERIUM AND HYDROGEN. K. M. Case, Robert Karplus, and C. N. Yang (Univ. of California, Berkeley). Phys. Rev. 101, 358-9(1956) Jan. 1.

It is pointed out that the following useful information can be obtained from experiments on K mesons in deuterium and hydrogen: (a) an indication of the K-particle spin; (b) a test of isotopic spin conservation in reactions involving strange particles; (c) a measurement of the Σ^0 mass. (auth)

4832

TOTAL CROSS SECTIONS FOR SCATTERING AND ABSORPTION OF PIONS BY NUCLEI. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 384-7(1956) Jan. 1.

The causality conditions of Goldberger for the pion-nucleon scattering have been used to calculate the parameter k_1 of the optical model for scattering of pions from nuclei. These values of k_1 together with values of the absorption coefficient K in nuclear matter were used to obtain the total absorption and diffraction cross sections of pions for carbon, copper, and lead in the range 0 to 2.5 Bev. (auth)

4833

MESON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS AT HIGH ENERGIES. Julius S. Kovacs (Indiana University, Bloomington). Phys. Rev. 101, 397-409(1956) Jan. 1.

Calculations based on a statistical model have yielded results concerning the relative probabilities for the different multiplicities and charge distribution of mesons produced in nucleon-nucleon collisions. In deviating from a pure statistical model the important effects of final state interactions and various selection rules have been included, using results of meson-nucleon scattering experiments. Notably in the results the suppression of some one-meson final states by consideration of the Pauli principle and conservation of angular momentum and parity, along with the enhancement of two-meson states due to resonance effects, have brought about results which are in closer agreement with experiment than predictions of a pure statistical nature. Account was taken of the final state interactions by considering separately the nucleon-nucleon and meson-nucleon interactions, a separation made plausible by consideration of the small amount of kinetic energy taken away by the more massive particles. Meson-meson interactions were neglected. The nucleon-nucleon interaction was taken care of by introducing in the statistical weight a factor which is the square of the wave function for the scattering of two nucleons evaluated at the origin of their interaction. The meson-nucleon final state scattering was treated by the method discussed by Chew, modified for the case of a meson scattering off two stationary and superposed nucleons. Multiplicities up to two mesons were considered. On comparing with experimental results, at 1.7-Bev bombarding energy of neutrons on protons the ratio of the probability of occurrence of the final states (np + –): (pp–0) : (pp–) is calculated to be 3.0 : 1.0 : 0.9, while experiment gives 3.3 : 1; 0.8. The ratio of the total probability for double meson production to that for single meson production at this energy is 1.2, while a modified result of observations gives 1.4. Results on proton-proton collisions do not yield good agreement with present observations. (auth)

4834

ELASTIC PHOTOPRODUCTION OF π^0 MESONS FROM DEUTERIUM. J. W. Rosengren and N. Baron (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 410-12(1956) Jan. 1.

The differential cross section for the reaction $\gamma + d \rightarrow \pi^0 + d$ has been measured for a broad spread (35 Mev) of γ-ray energies centered at about 280 Mev. The values as measured for three angles of the π^0 meson in the laboratory system are given. In addition to the uncertainties based on counting statistics, there is an absolute uncertainty of about 20% because of uncertainties in detection efficiency and bremsstrahlung spectrum. The results are in good agreement with similar, earlier measurements at Cornell University and with the theory of Chappelear. (auth)

4835
78-MEV $\pi^{\pm}$ MESON SCATTERING FROM LITHIUM. Ross Williams, James Rainwater, and Aihud Pevsner (Nevis Cyclotron Labs., Irvington-On-Hudson, New York). Phys. Rev. 101, 412-18(1956) Jan. 1.

The angular distributions of 78-Mev $\pi^{\pm}$ mesons scattered elastically from lithium have been measured. The distributions have been analyzed by combining coherently the scattering amplitudes for the individual pion-nucleon interactions, and weighting each amplitude by a form factor determining the ability of the struck nuclear harmonic oscillator well. Corrections are applied for solid angle transformations between the pion-nucleus and pion-nucleon center-of-mass systems, the effect of the required nuclear elastic scattering upon the available phase space in the pion-nucleon system, and an initial momentum distribution for the nucleons. The simple Born approximation treatment provides agreement with the pronounced dip at 75° and the backward rise of the experimental curves. (auth)

4836
EFFECT OF THE FINITE SIZE OF THE NUCLEUS ON μ-PAIR PRODUCTION BY GAMMA RAYS. George H. Rawitscher (Stanford Univ., Calif.). Phys. Rev. 101, 423-6 (1956) Jan. 1.

The cross section for μ-pair production by gamma rays is calculated by using the Bethe-Heitler formula, taking into account the finite nuclear size. The cross section is shown to be considerably smaller than that for a point-charge nucleus. (auth)

4837
COMPOUND HYPOTHESIS FOR THE HEAVY UNSTABLE PARTICLES. II. M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 433-8(1956) Jan. 1.

The compound hypothesis for hyperons and heavy mesons is restated, modifying an earlier assumption on the isotopic spin of θ^0. θ mesons and $\bar{\theta}$ mesons (antiparticles) are assumed to have isotopic spin $T = \frac{1}{2}$, as proposed by Gell-Mann. The total number of heavy mesons (θ mesons minus $\bar{\theta}$ mesons) is conserved in strong interactions (fast reactions). The fundamental reaction is thus pair creation of $\theta + \bar{\theta}$, with θ mesons free and $\bar{\theta}$ mesons either free or bound to nucleons ($\mathfrak{N}$). Hence $\mathfrak{N} + \bar{\theta}$ can form T = 0 and T = 1 multiplets which are identified with the Λ^0 singlet and the Σ triplet, respectively. The facts known about hyperons, associated production, and interaction of heavy mesons with nucleons are consistent with our assumptions. A discussion of T-multiplets among hypernuclei is given. Some experiments which may throw new light on the compound hypothesis are discussed. (auth)

4838
$K^+ - \tau^+$ MASS DIFFERENCE. S. Fung, A. Pevsner, and D. Ritson (Massachusetts Inst. of Tech., Cambridge) and N. Mohler (Smith Coll., Northampton, Mass.). Phys. Rev. 101, 493-4(1956) Jan. 1.

A stack of 100 emulsions was exposed to the focused and magnetically analyzed K meson beam at Berkeley. Ranges of K^+ and τ^+ mesons of the same momentum in emulsion are given, and from these data the mass difference is determined to be $m_{\tau^+} - m_{K^+} = (4 \pm 4)m_e$. (B.J.H.)

4839
MEAN LIFE OF K^+ MESONS. V. Fitch and R. Motley (Princeton Univ., N. J.). Phys. Rev. 101, 496-8(1956) Jan. 1.

The differential range curve and the mean life of the K^+ mesons produced in the Brookhaven cosmotron were determined. The mean life was found to be $(12.1^{+1.1}_{-1.0}) \times 10^{-9}$ sec for $K_{\pi 2}$ mesons and $(11.7^{+0.8}_{-0.7}) \times 10^{-9}$ sec for $K_{\mu 2}$ mesons. (B.J.H.)

4840
LIFETIME OF K MESONS. Luis W. Alvarez, Frank S. Crawford, Myron L. Good, and M. Lynn Stevenson (Univ. of California, Berkeley). Phys. Rev. 101, 503-5(1956) Jan. 1.

The K mesons produced in the Bevatron were observed by means of a counter telescope. Mean lives were found to be $(1.4 \pm 0.2) \times 10^{-8}$ sec for $K_{\mu 2}$ mesons and $(1.3 \pm 0.2) \times 10^{-8}$ sec for the $K_{\pi 2}$ mesons. (B.J.H.)

4841
BRANCHING RATIOS IN HYPERON AND HEAVY-MESON DECAYS. Gregor Wentzel (Institute for Nuclear Studies, Chicago). Phys. Rev. 101, 505-6(1956) Jan. 1.

It is suggested that branching ratios and lifetimes may be correlated by assuming that only certain selected decay processes are truly elementary whereas the others would be indirect processes involving the elementary transition as a virtual intermediate step. (B.J.H.)

4842
NATURE OF THE NEUTRAL PARTICLES IN THE $K_{\mu 3}$ DECAY. G. Yekutieli, M. F. Kaplon, and T. F. Hoang (Univ. of Rochester, N. Y.). Phys. Rev. 101, 506-7(1956) Jan. 1.

Emulsions exposed to the K^+ meson beam of the Bevatron show the decay at rest of a K^+ meson into an electron-positron pair and a μ^+ meson. The event is interpretable as $K\mu_3^+ \rightarrow \mu^+ + \pi^0 + (\pi^0 \text{ or } \gamma \text{ or } \nu)$ if the interpretation is restricted to 3-body decay schemes. (B.J.H.)

Refer also to abstract 5018.

NEUTRONS

4843 AD-65679
North Carolina State Coll., Raleigh.
THEORY OF SLOWING DOWN LENGTH OF NEUTRONS IN HYDROGENOUS MIXTURES (thesis). Kenneth Byron Fess. 1955. 41p.

4844 CF-54-8-104
[Oak Ridge National Lab., Tenn.]
SINGLE ANISOTROPIC AIR SCATTERING OF NEUTRONS IN THE PRESENCE OF THE GROUND (SHIELDED DETECTOR). F. H. Murray. Aug. 18, 1954. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A point source is assumed to emit a beam of neutrons directed towards a detector placed back of a surface parallel to the reactor detector direction and is shielded by a thickness of water. Neutrons activating the detector arrive mostly from a direction making a small angle with the normal to the surface in front of the detector. A formula is calculated for the neutron intensity at the detector. (F.S.)

4845 KAPL-1522
Knolls Atomic Power Lab., Schenectady, N. Y.
THE CALCULATION OF MAXWELLIAN AVERAGED CROSS SECTIONS FOR RESONANCE ABSORBERS. J. H. Smith. Mar. 21, 1956. 24p. Contract W-31-109-Eng-52. $0.25(OTS).

The average cross section for a resonance absorber in a Maxwellian neutron spectrum is expressed by formulas which permit accurate and simple evaluation for a wide range of nuclear parameters. (auth)

4846 NAA-SR-Memo-1123
North American Aviation, Inc., [Downey, Calif.].
DISCUSSION OF THE MEASUREMENTS OF NEUTRON ATTENUATION BY SHIELD MATERIALS MADE ON THE WBNS. F. L. Fillmore. Oct. 14, 1954. Decl. May 11, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

Measurements of the attenuation of thermal and fast neutrons by shield materials were made on the WBNS. The experimental attenuation constants for thermal, epithermal, and fast neutrons were obtained for Fe, Al, ordinary concrete, and magnetite concrete. Results of the measurements are discussed in terms of the nuclear cross sections of the various materials. (C.H.)

4847 NP-5868

North Carolina State Coll., Raleigh.

THE SLOWING DOWN DISTRIBUTION OF FISSION NEUTRONS IN HYDROGENOUS MATERIALS. Claude Curtis Cardwell. June 1955. 50p. Contract DA-36-034-ORD-1656.

Apparatus for the measurement of the fission neutron slowing down distribution in water and other hydrogenous mixtures was designed, assembled and given preliminary test. The activation of In foils inserted in a four-foot tank is produced by a neutron flux distribution in the medium. The source of fission neutrons is an enriched U plate irradiated with thermal neutrons. In the tests of the equipment, it was found that additional care in the collection and treatment of data would be required. An analysis of improvements in method is presented. (auth)

4848 NP-5869

North Carolina State Coll., Raleigh.

MEASUREMENT OF NEUTRON DISTRIBUTIONS IN HYDROGENOUS MATERIALS. George Horace Ogburn, Jr. June 1955. 58p. Contract DA-36-034-ORD-1656.

Equipment for the measurement of slowing-down-length of neutrons in hydrogenous mixtures by In foil activation was designed, constructed and assembled. The principal components consisted of a tank for containing the hydrogenous medium, a sealed container and apparatus for use in the utilization and storage of the U^{235} fission neutron source, the foil holders, foil rack and In foils. The results obtained differed considerably from the expected values. They were analyzed and discussed with the purpose of pointing out the possible sources of error and suggesting the improvements in technique and modifications of equipment required for the success of future experiments of this type. (auth)

4849

NEUTRON DIFFUSION THROUGH A SLAB. Marc Feix and Simone Valentin. Compt. rend. 242, 617-20(1956) Jan. 30. (In French)

A study was made of the matrix solution of the exact integral equation for diffusion obtained under certain conditions (isotropy-constance of the effective cross sections for successive impacts). The coefficients of reflection and transmission were found for a beam normal to a slab. A comparison is made with the result obtained by the Monte Carlo method. (tr-auth)

4850

MEASUREMENTS OF INELASTIC SCATTERING CROSS SECTIONS FOR FAST NEUTRONS. J. J. Van Loef and D. A. Lind (Univ. of Wisconsin, Madison). Phys. Rev. 101, 103-13(1956) Jan. 1.

Cross sections for inelastic neutron scattering by Fe, Mn, I, and F have been measured with a collimated neutron beam by observing the gamma radiations from the excited states. Excitation curves for the 850-kev level of Fe^{56}, the 128-kev level of Mn^{55} and the levels at 62, 208, 435, and 632 kev in I^{127} were compared with the Hauser-Feshbach theory. The nuclear penetrabilities were obtained from the "cloudy crystal ball" model. In general, the best agreement with theory was obtained for the value of the nuclear absorption corresponding to a "black" nucleus. The angular distribution of the 850-kev radiation from Fe^{56} was given by: $W(\theta) = 1 + (0.54 \pm 0.05)P_2(\cos\theta) - (0.28 \pm 0.05)P_4(\cos\theta)$. Excitations of levels at 980 kev in Mn^{55}; at 390, 725, and 950 kev in I^{127}, and at 110, 197, and 1560 kev in F^{19} were also observed. No levels in S^{32} or Sr below 1 Mev were found. The excitation curves cannot be used to determine spins of excited states and even where spins and parities are known the agreement with theory is not good. (auth)

4851

DYNAMICS OF NEUTRON SCATTERING BY MOLECULES. A. C. Zemach and R. J. Glauber (Harvard Univ., Cambridge, Mass.). Phys. Rev. 101, 118-29(1956) Jan. 1.

The scattering of low-energy neutrons by molecules is investigated by a method which facilitates the treatment of inelastic processes. Dynamical systems characterized by the degrees of freedom of gas molecules are examined in detail. The formalism is applied first to the derivation of the differential cross section for scattering by an ensemble of coupled harmonically oscillating nuclei in thermal equilibrium. Rotator scattering is investigated in the limits of high and low energy, and inelastic corrections to the static approximation are also calculated. The cross section of a thermally excited monatomic gas is presented in a closed form which shows its dependence on the ratio of the mean velocity of thermal motion to the neutron velocity. Results appropriate to large and to small values of the velocity ratio are derived. Quantitative estimates for the validity of the various approximations are given. (auth)

4852

NEUTRON DIFFRACTION BY GASES. A. C. Zemach and R. J. Glauber (Harvard Univ., Cambridge, Mass.). Phys. Rev. 101, 129-36(1956) Jan. 1.

The methods developed in the previous paper for the treatment of neutron scattering by simplified molecular models are extended to form a unified description of scattering by real molecules. The generalization takes into account the influence on scattering of the interactions that appear among the different molecular degrees of freedom. The effect of spin correlations within molecules due to symmetries occurring in the presence of like nuclei is explicitly determined. The slow-neutron cross section of methane is calculated and compared with experiment. (auth)

4853

STUDY OF THE VARIATION OF THE MEAN NUMBER OF NEUTRONS PRODUCED BY Pu^{239} FISSION. Jean-Michel Auclair, Harry Hill Landon, and Maurice Jacob. Compt. rend. 241, 1935-6(1955) Dec. 19. (In French)

The study of the variation of the mean number of neutrons produced per Pu^{239} fission with the energy of the incident neutron shows that, between the thermal region and 0.35 ev, ν is constant to about 1%. (tr-auth)

Refer also to abstracts 4941 and 5014.

NUCLEAR PHYSICS

4854 AERE-NP/L-1

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LECTURES ON THE THEORY OF NEUTRON SCATTERING. LECTURES I TO IV. D. M. Brink. Feb. 3, 1956. 19p.

Lectures delivered at Harwell during November 1955.

Lectures on neutron scattering theory, theory of average cross sections, optical model calculations, and strength functions are given. (D.E.B.)

4855 CF-55-9-74

[Oak Ridge National Lab., Tenn.]

TABLES FOR COMPUTING EFFECTIVE RESONANCE INTEGRALS, INCLUDING THE DOPPLER BROADENING

OF NUCLEAR RESONANCES. Lawrence Dresner. Sept. 19, 1955. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The theory of resonance integrals and Doppler boradening is discussed, and the equations used in programming the ORACLE are developed. Tables were prepared from ORACLE results. (D.E.B.)

4856 UCRL-4639

California. Univ., Livermore. Radiation Lab.

A SUMMARY OF HIGH-ENERGY NUCLEON-NUCLEON CROSS SECTION DATA. Wilmot N. Hess. Jan. 18, 1956. 74p. Contract W-7405-eng-48. $0.45(OTS)

A summary was made of experimental information on high-energy nucleon-nucleon cross sections. Corrections have been made to the original data when later information made it necessary. All of the data agree statistically and form a consistent picture. (auth)

4857

TERMINAL OBSERVATIONS ON "ANTIPROTONS". John M. Brabant, Bruce Cork, Nahmin Horowitz, Burton J. Moyer, Joseph J. Murray, Roger Wallace, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 101, 498-501(1956) Jan. 1.

Experiments are described which are meant to show that proton-mass particles produce events different from those associated with the passage of a negative pion beam. A glass Cherenkov counter was used to observe the events. The results which are reported are not inconsistent with the expected behavior of antiprotons. (B.J.H.)

4858

REDUCED WIDTHS FROM STRIPPING REACTIONS. J. M. Calvert, A. A. Jaffe, and E. E. Maslin (Univ. of Liverpool, England). Phys. Rev. 101, 501-2(1956) Jan. 1.

Targets of Be^9, C^{12}, N^{14}, O^{16}, and Si^{28} were chosen to yield mirror or corresponding levels and were bombarded by a beam of 9-Mev deuterons from the Liverpool cyclotron. Resulting proton and neutron groups were analyzed. It may be concluded that the reduced widths of the levels investigated gave no reasons for believing that any marked difference exists between the distributions of protons and neutrons in the nucleus, though the deviation of the ratios from unity is greater than the experimental error. (B.J.H.)

4859

GENERALIZATION OF THE LIQUID DROP MODEL OF FISSION. Th. A. J. Maris (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 101, 502-3(1956) Jan. 1.

A liquid drop model of fission is considered in which a homogeneous charge distribution has its surface at some distance inside the nuclear surface. The critical Z^2/A value for which a spherical nucleus becomes unstable is also calculated. (B.J.H.)

4860

PHYSICAL PROBLEMS CONNECTED WITH THE APPLICATIONS OF NUCLEAR ENERGY. C. Salvetti (Istituto di Fisica dell'Universita, Bari). Nuovo cimento (10) 2, Suppl. No. 3, 898-908(1955). (In Italian).

4861

NUCLEAR MODELS AND THE COLLECTIVE NUCLEUS. J. A. Wheeler (Princeton Univ., N. J.). Nuovo cimento (10) 2, Suppl. No. 3, 909-18(1955).

Changes in viewpoint on various nuclear models are reviewed, and the limitations of the models are discussed. (B.J.H.)

4862

ANTIPROTONS. O. Chamberlain, E. Segre, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). Nature 177, 11-12(1956) Jan. 7.

Theory had predicted the characteristics of the antiproton. Experiments were designed and performed which verified the existence of this particle. (D.E.B.)

4863

THE STORAGE OF FISSILE MATERIAL. A. J. Mayne (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 77-84(1955) Dec.

Estimates are obtained for the safe spacing between a given number of similar fissile spheres arranged in a linear, square, or cubic array. These estimates give upper bounds, so that they overestimate the size of the least spacing that is safe. Estimates are also obtained for the number of fissile spheres that may be stored safely in a regular linear, square, or cubic array, with given spacing between spheres. These estimates give lower bounds, so that they underestimate the maximum number that can be stored safely. The assumptions used in these calculations are stated, the chief one being that the probability of direct neutron passage from one sphere to another decreases at least as fast as the reciprocal of the distance between them. Some numerical examples are calculated. General arrays of fissile bodies are also considered briefly. (auth)

NUCLEAR PROPERTIES

4864 AD-53503

Washington Univ., St. Louis.

BETA SPECTRA OF VANADIUM-48 AND RUBIDIUM-86 (thesis). Lawrence Eugene Killion. Feb. 1955. 160p.

The disintegration schemes of a positron emitter (V^{48}) and a negatron emitter (Rb^{86}) are critically analyzed. A review of the essentials of the Fermi theory of β decay is presented along with an extension to forbidden transitions, spectral shape, and the transformation necessary to restore linearity to F-K plots in the case of unique type spectra. β-ray spectroscopy is discussed with particular reference to the 180° magnetic spectrometer which was used in experiments. Results indicated no evidence of the existence of a second positron group in V^{48}; in the case of Rb^{86}, however, evidence was found for an additional β group not previously reported in the literature. Rb^{86} data indicated that recent serious differences in experimental findings should not be attributed entirely to the conventional subtraction method of data analysis. (ASTIA abst.)

4865 CF-55-9-73

[Oak Ridge National Lab., Tenn.]

THE EFFECTIVE RESONANCE INTEGRALS OF U^{238} AND Th^{232}. Lawrence Dresner. Oct. 5, 1955. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Effective resonance integrals of U^{238} and Th^{232} at 300°K were calculated from reported resonance data. These calculations are plotted and compared with experimentally measured values. Agreement between theory and experiment is considered satisfactory. (D.E.B.)

4866 CF-55-6-144

Oak Ridge National Lab., Tenn.

AN EXAMINATION OF URANIUM-233 FISSION-YIELD DATA. S. Peterson. June 23, 1955. Contract [W-7405-eng-26]. 9p. $1.80(ph OTS); $1.80(mf OTS).

A survey is made of U^{233} thermal-neutron fission-yield data as found in the literature. (B.J.H.)

4867 CF-56-6-21

Oak Ridge National Lab., Tenn.

CROSS SECTION PROGRAM AT OAK RIDGE NATIONAL LABORATORY. J. L. Fowler and J. A. Harvey. June 4, 1956. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The ORNL cross section program is briefly surveyed, and all new cross sections are listed. (B.J.H.)

4868 TPI-78

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EXPERIMENTAL ATOMIC MASSES. I. W. Hay. Mar. 1955. 26p.

Atomic masses, which were calculated from recently published tabulations of mass spectroscopic doublet measurements, β-decay energies, and reaction Q values, are tabulated. The calculation methods are outlined. (B.J.H.)

4869 UCRL-3149

California. Univ., Berkeley. Radiation Lab.

CONCERNING K MIXING IN BOHR-MOTTELSON STATES OF SPHEROIDAL NUCLEI. John O. Rasmussen. Sept. 21, 1955. 6p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

General remarks are made on the representation of nucleonic wave functions for spheroidal nuclei. Theoretical rotational band spectra are given for an odd nucleon in orbitals of predominately $i_{13/2}$ character at large prolate deformation. (B.J.H.)

4870 UCRL-3388

California. Univ., Berkeley. Radiation Lab.

SOME PROPERTIES OF THE BERYLLIUM NUCLEUS OBTAINED FROM SCATTERING DATA (thesis). Robert G. Summers-Gill. Apr. 23, 1956. 99p. Contract W-7405-eng-48. $15.30(ph OTS); $5.40(mf OTS).

A Be target has been bombarded with 12-Mev protons, 24-Mev deuterons, and 48-Mev α particles. With the three projectiles the differential cross sections for inelastic scattering leading to the formation of the 2.43-Mev state have been measured. Application of inelastic scattering theory leads to the assignment 5/2 and odd parity for this level. A very weak inelastic proton group has been found, confirming the recently reported "level" in Be^9 at ~1.8 Mev. It is pointed out, however, that the observations can also be explained on the basis of heavy-particle stripping in the reaction $Be^9(p,np')Be^8$. The observation of inelastic α-particle groups corresponding to levels at 6.8 and 11.3 Mev permits the assignment of isotopic spin 1/2 to these states. The data obtained were not inconsistent with the existence of levels at 3.1 and 4.8 Mev. The pickup reaction $Be^9(p,d)Be^8$, in which Be^8 is left in its ground state, was also observed. While the distribution of deuterons is peaked forward as predicted by Butler stripping, its shape is the same as that found at other energies. Such behavior is not in agreement with the quantitative aspects of the theory. The reactions $Be^9(p,np')Be^8$ and $Be^9(\alpha,n\alpha')Be^8$ have been studied. Analysis of the angular distributions suggests that those processes in which the charged particle retains most ot the energy occur predominantly by direct interaction. Finally, the elastic scattering of protons, deuterons, and α particles has been observed. Analysis of the distributions on the basis of a black nucleus gives reasonable agreement with the positions of the diffraction features. The radii of interaction necessary are large, but consistent within themselves and with those which fit the inelastic data. (auth)

4871

LA RÉSONANCE PARAMAGNETIQUE NUCLEAIRE. MOMENTS DIPOLAIRES ET QUADRIPOLAIRES (NUCLEAR PARAMAGNETIC RESONANCE. DIPOLE AND QUADRUPOLE MOMENTS). P. Grivet, ed. Paris, Centre National de la Recherche Scientifique, 1955. 102p. Frs. 1,800 ($5.22) (In French)

Some introductory remarks are made concerning the theory of nuclear magnetism and a classical model according to Bloch's theory. More detailed discussions are included on the macroscopic and quantum theories of nuclear magnetism, the experimental methods, of observing the phenomenon, descriptions of the apparatus used to determine nuclear magnetism, methods of producing the magnetic fields used, gyromagnetic ratios, and numerical values of the magnetic moments of various nuclei and nuclear quadrupole resonance. (B.J.H.)

4872

PHOTODISINTEGRATION OF ^{16}O AND ^{63}Cu BY PHOTONS OF VARIABLE ENERGY. J. G. Campbell (Univ. of Melbourne, Australia). Australian J. Phys. 8, 449-55(1955) Dec.

Proton capture reactions in light nuclei provide γ radiation with energy controllable by variation of proton energy. The radiation from proton capture by Li^7 has been used to investigate the (γ,n) reactions in O^{16} and Cu^{63} over an energy range around 17·7 Mev. No resonant behavior was observed in O^{16}. A variation in the Cu^{63} photoneutron cross section is interpreted as the combined effect of many unresolved levels. (auth)

4873

PHOTOPROTONS FROM FLUORINE. W. B. Lasich, E. G. Muirhead, and G. G. Shute (Univ. of Melbourne, Australia). Australian J. Phys. 8, 456-67(1955) Dec.

The energy and angular distributions of protons produced in the $F^{19}(\gamma,p)$ reaction have been obtained for the photon energy range 10 to 16·5 Mev. An integrated cross section of 18 Mev-mbarn was obtained for this region. The angular distribution was found to be of the form $(a + b \sin^2\theta)$ with the ratio b/a strongly energy dependent. The higher energy protons show evidence of an independent particle-type interaction which is in plausible agreement with the shell model structure of F. The range-energy relation for the target gas, CF_4, is presented. (auth)

4874

INFORMATION ON ENERGY LEVELS IN Be^8 FROM NEUTRON ENERGY SPECTRA. J. R. Bird and R. H. Spear (Univ. of Melbourne, Australia). Australian J. Phys. 8, 567-72(1955) Dec.

Reported energy levels in the $Li^7(d,n)Be^8$ reaction are not consistent. The nuclear emulsion and neutron spectrometer techniques used are cited as a possible source of discrepancy. (D.E.B.)

4875

INTERPRETATION OF (d,t) ANGULAR DISTRIBUTIONS. A. Werner (Univ. of Sydney, Australia). Nuclear Phys. 1, No. 1, 9-19(1956).

Expressions derived from stripping theory by Butler and Salpeter are used to obtain the upper limit of 0.11 for the probability of finding the triton in the configuration of deuteron ground state plus second neutron, utilizing the experimental data on angular distributions for the protons in C^{12} (d,p) C^{13} and the tritons in C^{13} (d,t) C^{12}. (auth)

4876

THE ESTIMATION OF RESONANCE INTEGRALS. Lawrence Dresner (Oak Ridge National Lab., Tenn.) J. Nuclear Energy 2, 118-27(1955) Dec.

Resonance parameters are now known for quite a large number of nuclei. Using this data, and attempt is made to predict the parameters for nuclei on which measurements have not been made, and, in particular the resonance integrals of these nuclei are estimated. These estimated resonance integrals are then compared with the experimentally determined values. (auth)

4877

DETERMINATION OF THE INTENSITY OF THE ORBITAL Lα X RAYS FROM ELEMENTS OF ATOMIC NUMBER BETWEEN 73 AND 92. Jose Gomes Ferreira. Compt. rend. 241, 1929-32(1955) Dec. 19. (In French)

The variation of the intensity of the orbital Lα x rays was studied as a function of the atomic number (73 to 92). It is verified that the maxima occur in the thallium–lead region. (tr-auth)

4878

HALF LIFE OF THE 122 KEV LEVEL OF Cs^{131}. Hamlet Vartapetian, Louis Dick, Roger Foucher, and Nils Perrin. Compt. rend. 242, 103-5(1956) Jan. 4. (In French)

The half life of the 122-kev level of Cs^{131} was measured by the method of delayed coincidences. Its value is $(4 \pm 0.3) \times 10^{-9}$ sec. This transition is interpreted as being of the M1 forbidden type with $\Delta l = 2$, with a $g_{7/2}$ level. (tr-auth)

4879

COINCIDENCE STUDY OF THE INTERNAL BREMSSTRAHLUNG SPECTRUM ACCOMPANYING K CAPTURE BY Cs^{131}. Aron Michalowicz. Compt. rend. 242, 108-10 (1956) Jan. 4. (In French)

4880

CALCULATION OF THE GROUND LEVEL OF A THREE-ELECTRON ATOM BY THE PERTURBATION METHOD. Paul Kessler. Compt. rend. 242, 350-2(1956) Jan. 16. (In French).

4881

MASSES OF NUCLEI WITH $Z \geq 40$. G. Bussetti (Univ. of Turin and National Inst. of Nuclear Physics, Turin). Nuovo cimento (10) 2, 1301-7(1955) Dec. (In Italian)

The masses of nuclei with $Z \geq 40$ calculated by the semiempirical formula of the drop model are given. Two coefficients of the formula have been recalculated with the method of least squares. (auth)

4882

PROTON POLARIZATION IN (n,p) REACTIONS AND NUCLEAR OPTICAL MODEL. J. Sawicki (Univ. of Warsaw). Nuovo cimento (10) 2, 1322-5(1955) Dec. (In English)

The theory of proton polarization in nuclear reactions is briefly discussed. (B.J.H.)

4883

RECENT PROGRESS IN THE INTERPRETATION OF THE LEVEL SCHEMES OF LIGHT NUCLEI. L. A. Radicati (Istituto di Fisica dell'Universita, Napoli). Nuovo cimento (10) 2, Suppl. No. 3, 883-97(1955). (In Italian).

4884

INTERACTION OF CONDUCTION ELECTRONS AND NUCLEAR MAGNETIC MOMENTS IN METALLIC SODIUM. T. Kjeldaas, Jr. (Westinghouse Research Labs., East Pittsburgh, Penna.) and W. Kohn (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 101, 66-7(1956) Jan. 1.

The electronic wave function at the Fermi surface of metallic Na has been calculated. The resulting value of $|\psi|^2$ at a Na nucleus is discussed with reference to measurements of the Knight shift and the paramagnetic susceptibility. (auth)

4885

NUCLEAR SPIN-LATTICE RELAXATION TIME IN COPPER AND ALUMINUM. Alfred G. Redfield (Harvard Univ., Cambridge). Phys. Rev. 101, 67-8(1956) Jan. 1.

Nuclear spin-lattice relaxation times of Al^{27} in pure Al and Cu^{63} in annealed pure Cu have been measured at 2 and 4.2°K, using the adiabatic fast-passage technique suggested by L. E. Drain. At 4.2°K, $T_1 = 260 \pm 100$ milliseconds for copper and 370 ± 40 milliseconds for aluminum. The relaxation time is apparently inversely proportional to temperature, as predicted by Korringa, from 2 to 300°K. (auth)

4886

HFS SEPARATIONS AND HFS ANOMALIES IN THE $^2P_{\frac{1}{2}}$ STATE OF Ga^{69}, Ga^{71}, Tl^{203}, AND Tl^{205}. A. Lurio and A. G. Prodell (Columbia Univ., New York). Phys. Rev. 101, 79-83(1956) Jan. 1.

By use of the method of atomic beam magnetic resonance, the ground-state hyperfine structure splittings in the two common gallium and thallium isotopes have been measured. The measured values are: $\Delta\nu(Ga^{69}) = (2677.9875 \pm 0.0010) \times 10^6$ sec^{-1}, $\Delta\nu(Ga^{71}) = (3402.6946 \pm 0.0013) \times 10^6$ sec^{-1}, $\Delta\nu(Tl^{203}) = (21\,105.447 \pm 0.005) \times 10^6$ sec^{-1}, and $\Delta\nu(Tl^{205}) = (21\,310.835 \pm 0.005) \times 10^6$ sec^{-1}. A comparison of the ratio of the dipole coupling constants in the ground state of the two isotopes with the ratio of the nuclear g_I factors yields the hfs anomaly. Theoretical and experimental values of the anomaly are compared. (auth)

4887

SYSTEMATICS OF FISSION THRESHOLDS. W. J. Swiatecki (Institute for Mechanics and Mathematical Physics and Gustaf Werner Inst. of Nuclear Chemistry, Uppsala, Sweden). Phys. Rev. 101, 97-9(1956) Jan. 1.

An examination of the experimental data on fission thresholds and ground-state masses of nine nuclei shows that there is experimental evidence for a difference between the masses of even-even, odd-A and odd-odd nuclei in the deformed saddle-point configurations, analogous to the well-known difference for the ground states and that the trend with Z^2/A in the saddle-point masses is consistent with simple theoretical estimates based on a liquid drop type of model. This leads to a semiempirical formula for fission thresholds, which is found to be consistent also with estimates of thresholds made with the aid of the observed spontaneous fission half-lives of 28 nuclei. An analogous semiempirical formula for spontaneous fission half-lives is given. (auth)

4888

PROPERTIES OF Em^{221}. F. F. Momyer, Jr. and E. K. Hyde (Univ. of California, Berkeley). Phys. Rev. 101, 136-8(1956) Jan. 1.

A new isotope of the element emanation has been identified among the spallation products of thorium bombarded with 110-Mev protons. This isotope, Em^{221}, decays with a half life of 25 minutes. The decay goes 80% by β emission to Fr^{221} identified by its characteristic alpha particle groups and by the observance of the alpha particles of the decay products, At^{217} and Po^{213}. In 20% of its disintegrations Em^{221} emits an alpha particle of 6.0-Mev energy unresolved from the 6.0-Mev alpha particle of Fr^{221}, and gives rise to Po^{217}, a previously unreported isotope of polonium. Po^{217} has a half-life of less than 10 seconds and emits alpha particles of 6.54 ± 0.02 Mev. An attempt was made to isolate Em^{221} from a sample of Th^{229} where it should be found as a result of slight alpha branching of Ra^{225}. The experiment was negative and a lower limit of 500 years was placed on the partial alpha half-life of Ra^{225}. (auth)

4889

DECAY SCHEME OF GALLIUM-72. J. J. Kraushaar, E. Brun, and W. E. Meyerhof (Stanford Univ., Calif.). Phys. Rev. 101, 139-47(1956) Jan. 1.

The decay of Ga^{72} has been investigated with scintillation spectrometers, both single and in coincidence. Evidence has been found for the existence of levels in Ge^{72} at 0.69, 0.84, 1.46, 1.73, 2.06, 2.39, 2.51, 2.82, 3.04, 3.32, and 3.34 Mev. The 0.3-μsec isomeric state has been definitely determined to be the first excited level at 0.69 Mev and, as previously indicated, requires a spin of 0 and even parity. Spins and parities of the other levels of Ge^{72} are discussed. (auth)

4890

FISSION THEORY AND SEMIEMPIRICAL MASS FORMULA. Th. A. J. Maris (Nobel Inst. of Physics, Stockholm). Phys. Rev. 101, 147-8(1956) Jan. 1.

The fission theory of Bohr and Wheeler employs the semiempirical mass formula with the following constants: E_s (= surface energy) = $14A^{\frac{2}{3}}$ Mev; $x = E_{Coulomb}/2E_s = (1/47.8)(Z^2/A)$; nuclear radius = Coulomb radius = $1.47 \times 10^{-13} A^{\frac{1}{3}}$ cm. The experimental masses deviate systematically from the values calculated using this formula. In the present note it is shown that these differences may severely influence the results of the fission theory. A reduction of the standard error in the mass formula from 8 to 2 mMU has been achieved by using the following constants: $E_s = 17.8A^{\frac{2}{3}}$ Mev; Coulomb radius = $1.216 \times 10^{-13} A^{\frac{1}{3}}$ cm; $x = (1/50.1)(Z^2/A)$. The smaller x value and Coulomb radius, in addition to possible shell effects in the two halves of the deformed nucleus, decrease the stability of a symmetric deformation of the nucleus, decrease the stability of a symmetric deformation of the nucleus. (auth)

4891

ANGULAR DISTRIBUTION OF GAMMA RAYS IN COULOMB EXCITATION FROM Pt. F. D. Benedict (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 178-81(1956) Jan. 1.

A numerical calculation has been made of the angular correlation coefficient, $a_2(\xi)$, in Coulomb excitation in both the quantum-mechanical treatment and the semiclassical approximation. The parameters ξ and η were chosen to correspond to excitation of the 330-kev level of Pt^{194}. The radial integrals entering the quantum calculation have been evaluated in the semiclassical approximation. Both the classical and quantum calculations are found to reproduce the experimentally observed energy dependence of $a_2(\xi)$, and the quantum treatment gives rather satisfactory agreement with the experimental absolute values as well. (auth)

4892

NUCLEAR SURFACE EFFECTS. Roy A. Berg and Lawrence Wilets (Univ. of Copenhagen, Denmark). Phys. Rev. 101, 201-4(1956) Jan. 1.

The surface of the nucleus is treated by a phenomenological and self-consistent statistical method, neglecting Coulomb effects, in an attempt to correlate such nuclear properties as the volume energy, surface energy, falloff distance, and mean radius. Assuming a value of $\sim 3.3 \times 10^{-13}$ cm for the surface thickness we estimate the nuclear compressibility to be of the order of $125A + 210A^{\frac{2}{3}}$ Mev. A thinner nuclear surface (the experimental value is 2.5×10^{-13} cm) would lead to larger values for the compressibility and conversely. The nuclear potential is found to extend $\sim 0.7 \times 10^{-13}$ cm further in radius than the nuclear density. (auth)

4893

ENERGY LEVELS IN F^{19} FROM A STUDY OF THE $O^{18}(d,n)F^{19}$ REACTION. M. V. Harlow, J. B. Marion, R. A. Chapman, and T. W. Bonner (Rice Inst., Houston, Tex.). Phys. Rev. 101, 214-15(1956) Jan. 1.

A counter ratio investigation has been made of the $O^{18}(d,n)F^{19}$ reaction, using oxygen targets enriched to 40% O^{18}. A search was made for energy levels in F^{19} between excitation energies of 6.1 and 9.8 Mev. In this region, levels were found at 6.184 and 6.48 Mev. A resonance in the forward yield of neutrons from the deuteron bombardment of O^{18} was found at 1.64 Mev. The cross section for the $O^{18}(d,n)$ reaction was measured by comparing the yield with that from the $O^{16}(d,n)$ reaction, the cross section for which is known. (auth)

4894

INTERMEDIATE COUPLING IN THE 1p-SHELL. Dieter Kurath (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 216-24(1956) Jan. 1.

The region between He^4 and O^{16} is treated for the case of intermediate strength of spin-orbit coupling and central two-body interaction. Energy levels are presented as a function of the relative coupling strength parameter, α/K. Static electromagnetic moments are also computed as functions of α/K. Comparison with experimental results gives a fairly good picture, and determines a definite behavior for α/K as a function of mass number. A possible interpretation of this behavior is suggested. (auth)

4895

(p,d) PICK-UP DEUTERON MEASUREMENTS AT 95 MEV. W. Selove (Harvard Univ., Cambridge, Mass.). Phys. Rev. 101, 231-41(1956) Jan. 1.

Measurements in some detail have been made on carbon and beryllium, and a few measurements on other elements. On the Born approximation, the results can be analyzed to give the momentum distribution of the picked-up neutron, and consequently some information about its wave function. The probable validity of this approximation at 100 Mev is examined, and seems reasonably good. The experimental results for carbon and for the pickup of a "tightly-bound" neutron from beryllium show strong high-momentum components indicating that the nuclear wave function is not strictly of independent-particle nature but that strong two-body interactions are operative inside the nucleus. There is also some indication of alpha-particle substructure in C and Be. (auth)

4896

BACK-GOUDSMIT EFFECT IN HFS OF Na^{23} $3P_{\frac{3}{2}}$ AND THE ELECTRIC QUADRUPOLE INTERACTION COEFFICIENT. G. S. Bogle, J. N. Dodd, and K. H. Purser (Univ. of Otago, Dunedin, New Zealand). Phys. Rev. 101, 246 (1956) Jan. 1.

Recent rf resonance experiments, at zero magnetic field, on the hfs of Na^{23} $3P_{\frac{3}{2}}$ left some doubt as to whether the value of the electric quadrupole coefficient, b, was 2.6 or −21.6 Mc/sec. It is pointed out that the doubt can be resolved by experiments under Back-Goudsmit coupling conditions, since a resonance curve showing four or three main maxima will be observed, respectively, according as b = 2.6 or −21.6 Mc/sec. Under these conditions too, the Landé factor can be measured. Preliminary experiments are reported which give a value of 1.34 ± 0.02 for the Landé factor. (auth)

4897

INTERPRETATION OF SOME OF THE EXCITED STATES OF 4n SELF-CONJUGATE NUCLEI. H. Morinaga (Purdue Univ., Lafayette, Ind.). Phys. Rev. 101, 254-8(1956) Jan. 1.

An attempt is made to give a general account for some of the excited levels of 4n-type self-conjugate light nuclei, especially for characteristic low-lying 0^+ levels and also for the 2^+ levels which appear not too far above the 0^+ levels in every case except the O^{16} ground state. It is pointed out that these 2^+ levels may arise from the same configuration as the lower lying 0^+ states which are considered to be deformed. The degree of deformation is estimated from the 0^+-2^+ energy separation and found to correspond to quite high deformations in some cases. The 6.06-Mev, 0^+, pair emitting state in O^{16}, which is considered to be a "hole configuration" by Christy and Fowler, may be deformed and is suspected to have a shape like a line of four alpha particles. Also, a rotation-like series of levels with spins and parities, 0^+, 1^-, 2^+, 3^-, and 4^+ among the highly excited states of Mg^{24} which appears to correspond to a series expected for a linear rotator with six alpha particles in a line is discussed. With Ne^{20}, indications of medium-deformed states are gound. Analogous discussions on the levels in Be^8 and C^{12} are tried although the experimental evidence is less conclusive. (auth)

4898

EFFECT OF THE TENSOR FORCE ON THE LEVEL

STRUCTURE OF Li^6 AND Li^7. Arnold M. Feingold (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 101, 258-70(1956) Jan. 1.

The splittings of the $^3S_1$ and $^1S_0$ states of Li^6 and the P doublet states of Li^7 by the tensor force are calculated by a variational method which includes the effect of configuration interaction. Other forces which would contribute to the splitting, such as spin-dependent central forces or vector spin-orbit forces, are not considered. The method of calculation is based on the use of a variational function of the form $\psi = \psi_0 + \lambda t' \psi_0$, where t' is essentially the tensor force, treated as a perturbation on a central force oscillator wave function, ψ_0. The effect of the tensor force is shown to be equivalent to a mixture of ordinary and spin-exchange central forces plus a vector type spin-orbit force of rather complicated structure. Using a Hu-Massey Gaussian shape tensor potential, an S-state splitting of 1.4 Mev is found for Li^6 and an inverted P-doublet splitting of 380 kev is found for Li^7. A Yukawa shape potential would give similar results. In view of the approximations made in the analysis, these results are in reasonable agreement with the experimental splittings of 3.5 Mev and 480 kev for Li^6 and Li^7 respectively. The tensor force is found to contribute about 12 Mev to the binding energy of these nuclei and to introduce a 6 percent admixture of excited states into the ground state. The importance of configuration interaction is shown by a second-order perturbation calculation neglecting configuration interaction which gives entirely different results—a negligible S-state splitting for Li^6 and a normal P doublet structure for Li^7. The effect of the tensor force on the P-doublet separation in Be^7 and the F doublet separation in Li^7 is discussed briefly. (auth)

4899

ISOTOPIC SPIN IMPURITY. II. SHELL MODEL. W. M. MacDonald (Princeton Univ., N. J.). Phys. Rev. 101, 271-9(1956) Jan. 1.

The isotopic spin impurity introduced into nuclear states by the Coulomb interaction is calculated with jj-coupling shell-model wave functions. Upper limits on the impurity present in $N = Z$ nuclei for $4 \leq A \leq 16$ are given and shown to be in agreement with the experimental work of Wilkinson on the isotopic spin selection rule for E1 transitions. (auth)

4900

LOW-LYING LEVEL STRUCTURE OF THE Zn^{65} NUCLEUS. Jerry B. Marion and Richard A. Chapman (Rice Inst., Houston, Tex.). Phys. Rev. 101, 283-5(1956) Jan. 1.

Sulfur and beryllium samples have been used as energy-selective neutron absorbers to investigate the low-lying level structure of the Zn^{65} nucleus. The transmission through the samples of the neutrons from the $Cu^{65}(p,n)Zn^{65}$ reaction was measured as a function of the proton energy, and the known resonances in the neutron total cross sections of S and Be were observed for both the neutron group leaving Zn^{65} in the ground state and for a group leaving Zn^{65} in an excited state at 118 ± 8 kev. At a proton energy of 2.9 Mev, these two groups are of approximately the same intensity. The Q-value for the $Cu^{65}(p,n)Zn^{65}$ reaction was found to be −2.141 ± 0.005 Mev. The 585-kev resonance in S was observed with neutrons from the $V^{51}(p,n)Cr^{51}$ reaction, and the threshold energy of 1.566 Mev for this reaction was confirmed. (auth)

4901

NUCLEAR RESONANCE FLUORESCENCE IN Ge^{72} AND Ge^{74}. Franz R. Metzger (Bartol Research of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 101, 286-94(1956) Jan. 1.

With gaseous sources of As^{72} and As^{74}, large nuclear resonance fluorescence effects have been observed for the 835-kev excited state of Ge^{72} and for the 596-kev excited state of Ge^{74}. The angular distribution of the resonance radiation characterizes the spins of both these excited states as 2 and the spins of the ground states as 0. From the magnitude of the resonance fluorescence effects, the mean lives of the 835-kev and 596-kev gamma-ray transitions were determined as $(4.6 \pm 1.2) \times 10^{-12}$ second and $(1.9 \pm 0.3) \times 10^{-11}$ second, respectively. These lifetimes are approximately one order of magnitude shorter than those expected for electric quadrupole transitions on the basis of the single particle model. The influence of collisions in the gas on the observed resonance fluorescence effect was studied using the 596-kev level in Ge^{74}. (auth)

4902

NEUTRON CROSS SECTIONS FOR ZIRCONIUM. Janet B. Guernsey and Clark Goodman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 294-7(1956) Jan. 1.

The inelastic neutron cross section for the excitation of the 930-kev level in zirconium has been measured as a function of neutron energy between 0.9 and 2.2 Mev. The de-excitation gamma radiation has been observed with a single-crystal NaI(Tl) spectrometer. Isotopic assignment of the observed level is still uncertain. The total cross section for zirconium has been measured for neutrons with energies between 0.7 and 1.2 Mev, using a hydrogen recoil counter in a good-geometry transmission experiment. Some correlation between inelastic and total cross sections has been observed. (auth)

4903

EXCITATION FUNCTIONS AND ANGULAR DISTRIBUTIONS OF ALPHA PARTICLES LEADING TO THE GROUND AND FIRST EXCITED STATES OF Be^7 IN THE REACTION $B^{10}(p,\alpha)Be^7$. James W. Cronin (Univ. of Chicago). Phys. Rev. 101, 298-307(1956) Jan. 1.

Measurements on the excitation function and angular distribution of $B^{10}(p,\alpha)Be^7$, Be^{7*} have been carried out with apparatus which is an improvement over that used for previous measurements. Excitation functions have been measured at laboratory angles of 90° and 145° with respect to the bombarding beam, from 0.8 to 1.65 Mev. Angular distributions have been measured at 1.0, 1.2, 1.36, 1.5, and 1.63 Mev, and at 1.3, 1.5, and 1.63 Mev for the excited state. The excitation functions show resonances at 1.17 and 1.5 Mev for the ground state, and 1.55 Mev for the excited state transition. The resonances are superposed on a continuous isotropic background. The 1.17-Mev resonance shows nearly an isotropic distribution to the ground state. The 1.5-Mev state shows a distribution which is $1-0.53\cos^2\theta$ with very small interference terms. The angular distributions leading to the excited state show a marked asymmetry with the backward angles being favored. The absolute cross section at laboratory 90°, $E_p = 1.5$ Mev for the ground state transition, is 21.1 ± 4 mb/sterad. This value is in resonable agreement with previous work. The angular distributions are not inconsistent with an assignment of $3/2^-$ for the 9.70-Mev state and $7/2^+$ for the 10.06-Mev state in C^{11}. (auth)

4904

COMPARISON OF DIFFERENTIAL CROSS SECTIONS FOR THE REACTIONS $C^{12}(d,p)C^{13}$ AND $C^{12}(c,n)N^{13}$. R. E. Benenson, K. W. Jones, and M. T. McEllistrem (Univ. of Wisconsin, Madison). Phys. Rev. 101, 308-10(1956) Jan. 1.

The differential cross sections for the reactions $C^{12}(d,p)C^{13}$ and $C^{12}(d,n)N^{13}$ to the ground states of the mirror nuclei C^{13} and N^{13} are reported for deuteron bombarding energies of 2.68 Mev and 3.26 Mev. The angular distributions at the forward angles are in agreement with those predicted from the formalism of Butler for both reactions. The cross sections are compared at the angle of the first stripping peak, and this comparison indicates

that the reduced widths of the mirror nuclei C^{13} and N^{13} are the same. This is in agreement with the assumption of the charge symmetry of nuclear forces. (auth)

4905

ENERGY DEPENDENCE OF THE OPTICAL MODEL PARAMETERS. Michel A. Melkanoff, S. A. Moszkowski, John Nodvid, and David S. Saxon (Univ. of California, Los Angeles). Phys. Rev. 101, 507-9(1956) Jan. 1.

The energy dependence of both the real and the imaginary parts of the nuclear potential is given in tabular and graphical form. (B.J.H.)

4906

EFFECT OF HARD CORE ON THE BINDING ENERGIES OF H^3 AND He^3. Takashi Kikuta and Masami Yamada (Univ. of Tokyo) and Masato Morita (Kobayasi Inst. of Physical Research, Tokyo). Phys. Rev. 101, 509-10(1956) Jan. 1.

A variational method was used to calculate the effect of the hard core on the Coulomb energy difference between H^3 and He^3 and the dependence of the H^3 binding energy on the radius of the hard core. (B.J.H.)

Refer also to abstract 5011.

NUCLEAR REACTORS

4907 AD-50430

North Carolina State Coll., Raleigh.

DESIGN ANALYSIS FOR A NUCLEAR POWER REACTOR (thesis). Martin Broomall Bales. 1955. 120p.

An investigation of the economic and social implications of nuclear power indicated that, under current circumstances, reactors which are specifically intended for the generation of electricity are most appropriate for development. The slightly enriched, Na-cooled, graphite moderated system shows the greatest promise of producing economical power at an early date. A general mathematical design analysis is presented for the purpose of recommending the most logical approach to the determination of a compatibility relation which simultaneously satisfies engineering and nuclear requirements; results showed that there exists a function which contains 2 variables, internal and external rod dimensions, and satisfies all compatibility requirements. (auth)

4908 AECU-3160

Michigan. Univ., Ann Arbor. Engineering Research Inst.

STUDY OF THE FEASIBILITY OF AQUEOUS RECOVERY OF SPENT FUELS. PART I. DISSOLUTION EXPERIMENTS ON ALLOY SAMPLES. Philip J. Elving, John L. Griffin, and John O. Larson. June 1954. 23p. Project 2240. (ERI-2240-1-F).

Work done for Dow Chemical-Detroit Edison and Associates, Atomic-Power Development Project at request of Consumers Power Co. (Jackson County).

The dissolution of Fe–U alloys by $HF-HNO_3$ solutions was investigated. The dissolution rates were not affected by presence of dissolved Fe if HNO_3 concentration was kept constant. The amount of HNO_3-insoluble material in the alloys averaged $4 \pm 1\%$. (C.W.H.)

4909 AECU-3170

Oak Ridge National Lab., Tenn.

A PACKAGE POWER REACTOR FOR REMOTE LOCATIONS. A. L. Boch. [1955]. 32p. Contract [W-7405-eng-26]. $0.25(OTS).

Design concepts for a package power reactor suitable for remote locations are reviewed. Design data, shielding, and plant operation are discussed. (C.H.)

4910 AECU-3197

General Electric Co. Atomic Power Equipment Dept., Schenectady, N. Y.

TERMINAL REPORT TO U.S. ATOMIC ENERGY COMMISSION [FOR] DECEMBER 20, 1954 TO JULY 9, 1955. Dec. 2, 1955. 6p. $1.80(ph OTS); $1.80(mf OTS).

A survey was made of reactors believed to be suited for most effective competition with conventionally fueled power plants in continental USA. Basic design data are summarized for a light-water-moderated boiling reactor and aqueous homogeneous reactors. (C.H.)

4911 AECU-3254

Division of Civilian Application, AEC.

TRANSPORTATION COSTS FOR IRRADIATED MTR FUEL ELEMENTS. 6p. $0.10(OTS).

4912 AERE-N/R-134

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MEASUREMENT OF THE LAPLACIAN IN A LATTICE OF URANIUM METAL RODS AND GRAPHITE. D. V. Booker, W. S. Eastwood, F. W. Fenning, T. M. Fry, and E. R. Wiblin. Oct. 1947. Decl. Nov. 8, 1955. 26p.

The critical size of a pile built up of a particular arrangement of fissile material and moderator can be related to the Laplacian of the arrangement. In these experiments the Laplacian has been measured for three arrangements in order to check the effect on critical size of a thin annulus of water around the U rods, and a 2 cm. wide annulus of air around the U rods. The arrangement studied consisted of U rods of 1.36-in. diameter spaced at 9-in. intervals in a block of graphite 10 ft., 6 in. by 10 ft., 6 in. by 9 ft high, the U rods being enclosed in concentric Al tubes so that water could be placed in the annular space between the tubes. The method of measurement was to determine thermal neutron densities throughout the structure when a point source of neutrons was placed at the base. Indium foils were used to detect the neutrons and the experimental density distributions were fitted to the expected theoretical form. The constants necessary to give a least square fit were used to reduce $\mathcal{K}^2$. The results obtained were: no water present, with air-gap $\mathcal{K}^2 = 0.83 \pm 0.03\ m^{-2}$, no water present, without air-gap $\mathcal{K}^2 = 0.90 \pm 0.02\ m^{-2}$, water present, without air-gap $\mathcal{K}^2 = 0.58 \pm 0.02\ m^{-2}$. (auth)

4913 AERE-RP/M-45

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ONE-GROUP PERTURBATION THEORY FOR A CYLINDRICAL REACTING CORE. J. Codd. June 23, 1954. 12p.

Expressions are obtained for certain integrals which are required in the application of one-group perturbation theory to a cylindrical reacting core. Numerical results are given for the special case of a bare core. As a particular application of the theory, the change in reactivity is investigated when a rod of material is inserted into the core. The analysis is based upon a standard approximate expression for the neutron density distribution in a cylindrical core. (auth)

4914 AERE-RP/R-1713

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DIFFUSION THEORY OF THERMAL NEUTRON FINE STRUCTURE IN FINITE REACTORS. PART I. D. A. Newmarch. Sept. 1955. 77p.

By means of diffusion theory, expressions for the thermal neutron fine structure are obtained for assemblies consisting of fuel slabs set at a constant distance apart with moderator in between. The expressions are integral in form and the integrals have been solved for certain thermal neutron source distributions. (auth)

4915 AERE-RP/R-1778
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ANALYSIS OF CRITICAL ASSEMBLY AND KINETICS DATA OBTAINED FROM THE AIR-SPACED PLUTONIUM CORE ASSEMBLY (CORE II) OF ZEPHYR. A. R. Baker and D. D. McVicar. Jan. 2, 1956. 13p.

The U-spaced Pu core (Core I) used in the first critical assembly of Zephyr has been replaced by an air-spaced core. The subsequent critical assembly, the reactivity calibration of control elements, and the kinetic behavior of the reactor are described. The decay of the neutron population after shutdown was analyzed into five exponentials with periods corresponding to the five groups of delayed neutrons found by Hughes et al. The group of period 1.1 sec found with Core I is assumed to be groups 4 and 5 of Core II unresolved. With this identification there is no significant difference between the delayed neutron groups obtained with Core I and Core II. (auth)

4916 ANL-5334
Argonne National Lab., Lemont, Ill.
ESTIMATION OF FISSION PRODUCT SPECTRA IN FUEL ELEMENTS DISCHARGED FROM THE POWER BREEDER REACTOR AND THE EXPERIMENTAL BREEDER REACTOR NO. 2. I. G. Dillon and Leslie Burris, Jr. Oct. 1954. Decl. Sept. 23, 1955. 36p. Contract W-31-109-eng-38. $0.30(OTS).

The basic data necessary for these calculations are the fission yield data as a function of mass number. Data were available from which the fast fission product spectra of Pu fissioned with 2-Mev neutrons and of U^{235} fissioned with 1-Mev neutrons could be estimated. Neither of these neutron energies duplicate conditions in the above two fast reactors in which the average fast neutron energy is estimated to be about 100 kev, but the data were considered sufficiently accurate for this purpose. Furthermore, the errors are not likely to be great and are conservative; that is, the calculated yield of such elements as Ru, Rh, and Pd which are difficult to remove by slagging will probably be slightly higher than actually found in the fuel from these reactors. For the PBR (Power Breeder Reactor) calculations, the fuel element was assumed to be in the pile for 135 days (in accordance with preliminary specifications) with fissions occurring at such a uniform rate that 2% of the total fuel element atoms would have fissioned at the time of discharge. The same bases were used for EBR-II fuel elements. Also, to show the effect of pile irradiation time, cases were calculated for 85 days pile irradiation and 15 days cooling for both PBR and EBR-II reactors. For this range the changes in fission product spectra were small. (auth)

4917 ANL-5577
Argonne National Lab., Lemont, Ill.
SOME PROBLEMS IN THE SAFETY OF FAST REACTORS. R. O. Brittan. [May 1956]. 67p. Contract [W-31-109-eng-38]. $0.45(OTS).

A safety survey of fast reactor systems was begun at Argonne National Laboratory by studying the characteristic kinetic behavior of such systems. To make this study possible, the problem of programming and coding the solution to the equations describing this behavior for the available digital computer (AVIDAC) was undertaken. (auth)

4918 BNL-378
Brookhaven National Lab., Upton, N. Y.
A TWO-GROUP REACTOR CARD PROGRAM FOR A SMALL DIGITAL COMPUTER. John Lamarsh and Stuart S. Rideout. May 1956. 31p. $0.25(OTS).

The design of thermal reactors frequently requires repeated computations using the two-group reactor equations. Since these are somewhat complicated, it is desirable to use an electronic computer. For many years, programs have been available for such problems for use on computers of the IBM-CPC variety and larger. In this report, a card programming method is presented by which these computations can be performed on the Remington Rand 409-2R computer, a low capacity machine designed primarily for business applications. (auth)

4919 BNL-386
Brookhaven National Lab., Upton, N. Y.
GAMMA-RAY NEUTRON DOSIMETRY OF THE BIOLOGY NEUTRON IRRADIATION FACILITY. J. S. Handloser and N. Delihas. Nov. 1955. 13p. $0.15(OTS).

Measurements of neutron flux and energy distribution, and gamma-ray intensities were made in the thermal column of the Brookhaven reactor. The thermal neutron flux was measured with gold foils; resonance neutrons with copper wire; fast neutrons with Pu, U, and S threshold detectors; and gamma intensity with a carbon ionization chamber. Measurements were made for the empty thermal column, the thermal column with a U^{235} converter plate, and the instrument tunnel. Results of all measurements and experimental details are presented. (auth)

4920 BNL-1344
Brookhaven National Lab., Upton, N. Y.
TEMPERATURE COEFFICIENTS OF REACTIVITY OF REACTORS. Jack Chernick. Jan. 9, 1953. Decl. Dec. 2, 1955. 22p. Contract AT-30-2-Gen-16. $0.25(OTS).

Experimental and theoretical investigations of the uniform temperature coefficient of reactivity (the reactivity change per degree rise in temperature of all the reactor constituents in some limited and defined temperature range) are described. (L.M.T.)

4921 CEA-481
France. Commissariat à L'Energie Atomique, Paris.
LES PILES DE RECHERCHE. (Research Reactors). L. Kowarski. Aug. 1955. 37p.

A survey was made of the various features and uses of research reactors. Included are a list of experiments which can be made with research reactors, technological considerations in the choice of a research reactor, the possibilities offered by the principal types of research reactors, and other considerations in the choice of a reactor. (B.J.H.)

4922 CF-52-8-223
[Oak Ridge National Lab., Tenn.]
REACTOR PHYSICS STAFF COURSE, SPRING 1952. R. L. Folger, S. V. Castner, and D. A. Orth. Aug. 21, 1952. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The final examination problems and their solutions are given. (D.E.B.)

4923 CF-53-12-126
Oak Ridge National Lab., Tenn.
THE OAK RIDGE NATIONAL LABORATORY GRAPHITE REACTOR. C. D. Cagle. [Dec. 1953]. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A detailed description of the ORNL Graphite Reactor history and operations are given. (R.V.J.)

4924 CF-54-10-111
Oak Ridge National Lab., Tenn.
COST ESTIMATING INFORMATION. TBR Memorandum No. 4. M. I. Lundin. Oct. 25, 1954. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Estimates of straight-thru type heat exchanger costs and a method of estimating the effect of varying design parameters are presented for use in TBR optimization studies. (auth)

4925 CF-55-1-76
Oak Ridge National Lab., Tenn.
DESCRIPTION AND OPERATING MANUAL FOR THE THREE GROUP, THREE REGION REACTOR CODE FOR ORACLE. R. R. Bate, L. T. Einstein, and W. E. Kinney. Jan. 13, 1955. 47p. Contract [W-7405-eng-26]. $7.80 (ph OTS); $3.30(mf OTS).

The theory of the three-group, three-region reactor code is outlined, and an operations manual for data input and code running are given. (D.E.B.)

4926 CF-55-7-130
California Research Corp., Richmond, Calif.; Brookhaven National Lab., Upton, N. Y.; and Oak Ridge National Lab., Tenn.
FAST NEUTRON FLUX MEASUREMENTS IN E-25 OF THE BROOKHAVEN GRAPHITE REACTOR. J. B. Trice. July 27, 1955. 21p. $4.80(ph OTS); $2.70(mf OTS).

Monitor materials used for obtaining flux information included Al, Co, **Mg**, powdered magnesium pyrophosphate, and S. Standard β^- counting techniques were used for the monitors. Principal results are given in graphical form. (B.J.H.)

4927 DL-25
Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.
THE HEAVY WATER REACTOR FOR POWER. W. B. Lewis. May 14, 1956. 52p. (AECL-319).

The advantages of heavy water as moderator and coolant in reactors for economic power are mainly its negligible capture of neutrons and the ease of maintaining it. It is shown that in comparison with Na and ordinary water as coolant, the saving in fuel costs can more than offset the losses and interest charges of the heavy water at the U.S. price of $28/lb. Moreover, it is possible to use natural U both as the initial and make-up fuel. A further possibility is envisaged that a very long irradiation of an artificial fuel, initially U^{235} + Th, may prove economic because of the reduction of processing costs. Moreover on the U^{233}–Th cycle the use of heavy water may make it possible to achieve a net gain from breeding U^{233}. Against these advantages must be set the necessity for controlling loss not only on account of its cost but also because of the ingestion hazard of its rising content of H^3. Heavy water enjoys the same advantages as ordinary water of possessing good heat transfer properties but also the disadvantage that steam pressures become high at relatively low temperatures. Both are also chemically active at high temperatures and attention must be paid to the control of corrosion. The relative advantages of the pressurized tube and pressure shell type of construction are reviewed and a promising type of pressurized tube construction is suggested, that preserves good neutron economy. The paper is mainly projected towards very low power costs in which the total of fuelling costs is less than 1 mill per kwh. (auth)

4928 HW-37955
Hanford Atomic Products Operation, Richland, Wash.
CALCULATION OF EFFECTIVE RADII OF CYLINDRICAL CONTROL RODS OF VARIOUS RADII AND BLACKNESSES. Towner A. Jayne. Apr. 1952. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The effective radii of infinitely long cylindrical control rods of various radii and blacknesses were calculated. The results are presented graphically. (D.E.B.)

4929 IGR-R/R-169
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
MODIFIED RAYLEIGH-RITZ PROCEDURE FOR DETERMINING AN UPPER BOUND FOR THE CRITICAL LAPLACIAN FOR ONE GROUP DIFFUSION THEORY. R. T. Ackroyd. Apr. 11, 1956. 17p. (WHC(C) P-63).

A modified Rayleigh-Ritz procedure is given for obtaining an upperbound for the critical Laplacian of a reflected fissile body according to one group diffusion theory. (auth)

4930 ISC-709
Ames Lab., Ames, Iowa.
HANFORD SLUG PROGRAM SEMI-ANNUAL SUMMARY RESEARCH REPORT [FOR] JULY 1 TO DECEMBER 31 1955. P. Chiotti and O. N. Carlson, comps. Apr. 16, 1956. 23p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

The kinetics and mechanism of the α, β, and γ transformations in U and the effects of heat treatment on the physical properties of U were studied. The corrosion of U by liquid Pb from 200 to 350°C was investigated. The vapor pressures of Zr–Zn alloys at low Zr content and the thermal diffusivity of Armco iron and U from 25 to 1000°C were measured. (For preceding period see ISC-641.) (C.W.H.)

4931 ORNL-1839
Oak Ridge National Lab., Tenn.
DECONTAMINATION OF THE HOMOGENEOUS REACTOR EXPERIMENT. D. O. Campbell. June 12, 1956. 44p. Contract W-7405-eng-26. $0.35(OTS).

After shutdown the Homogeneous Reactor Experiment system was decontaminated in about 1 month, without descaling, from an activity level of 1000 r/hr to 5 to 200 r/hr. This was sufficient to permit dismantling. The treatment consisted in washing twice with each of the reagents 5% HNO_3, 35% HNO_3, and 10% NaOH–1.5% $Na_2C_4H_4O_6$–1.5% H_2O_2 and numerous times with water. Overall decontamination factors were 22 to 25, including decay. Decontamination factors with a single reagent were between 1 and 2.25. More than 2000 curies each of Ce and Zr, more than 1000 curies each of Ba, Sr, and La, and large amounts of Nb, Ru, and I_2 were removed. The significant contaminants remaining were Nb and Zr. These could have been removed only by descaling the system, which laboratory experiments indicated would have given a further decontamination factor of about 100. (auth)

4932 ORNL-1894
Oak Ridge National Lab., Tenn.
A STABILITY CRITERION FOR REACTOR SYSTEMS. T. A. Welton. Oct. 17, 1952. Decl. May 9, 1955. Reissued July 7, 1955. 17p. Contract W-7405-eng-26. (CF-52-10-107). $0.20(OTS).

The stability of a reactor system is usually studied by assuming small deviations from the operating point and solving the linearized equations of motion. The required properties of the solutions can be found when the system is described by a low-order differential equation. The combination, however, of integral operations and nonlinearities presents insuperable obstacles to general treatment. A brief sketch is presented of an approach to the problem of general treatment involving the solution of an integro-differential equation describing the dynamics of the system. The term "reactor system" refers to the reactor coupled to its heat removal system and a reactivity control system. (D.E.B.)

4933 ORNL-2068
Oak Ridge National Lab., Tenn.
ABSOLUTE DETERMINATION OF POWER PRODUCED IN A NOMINALLY ZERO POWER REACTOR. Stuart Snyder. June 4, 1956. 9p. Contract W-7405-eng-26. $0.15(OTS).

A method has been developed whereby the power produced in a low power reactor can be determined. Use is made of gamma-ray analysis of a sample of the fuel.

The rate of decay of a fission product, as measured by the intensity of one of the γ rays produced during its decay, was used to determine the production rate of the fission product at the point in the reactor where the fuel element piece was located. This is related to the fission rate by the fission product abundance. Using catcher foils one obtains relative power traverses. From these the relative power distribution and the average relative power can be determined. The ratio of average relative power to relative power yields absolute power when normalized to the absolute fission rate at the measured position. (auth)

4934 PNG-7

Pacific Northwest Power Group, Richland, Wash. AQUEOUS HOMOGENEOUS REACTORS. Second Annual and Final Report to Atomic Energy Commission. Feb. 1956. 21p. $0.25(OTS).

Three principal concepts for design of aqueous homogeneous type reactors are considered for nuclear power production. These include a simple burner, a two-region Th breeder reactor, and a single-region Th breeder reactor. The latter two types are believed to be the most promising. It is estimated that, if technical problems are solved, the Th breeder reactor should produce energy costing in the range of 6 mills/kw-hr at high plant load factor. The homogeneous reactor is considered to be adaptable to continuous processing and to have a lower fuel inventory than most other reactor types. Homogeneous reactors are also considered to be somewhat more adaptable to small sizes than other types of reactors. Problems, disadvantages, and cost estimates for each reactor type are discussed. (C.H.)

4935

EVALUATION OF THE NONLINEAR KINETIC BEHAVIOR OF A NUCLEAR POWER REACTOR. R. C. Howard (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Soc. Mech. Engrs. 78, 163-9(1956) Jan.

The transient response of a nuclear-reactor system can be extremely difficult to determine by analytical methods. Frequently, recourse must be made to a computational device if a complete description of the system is to be obtained. In this study, an analog computer was employed to investigate the transient behavior of a sodium-cooled, graphite-moderated heterogeneous reactor and its primary-loop heat exchanger. The twofold purpose of the study was to analyze this particular reactor system and to obtain a general evaluation of the errors that result from the simplifying assumptions often made to solve reactor transient problems. The most important result of the study is the demonstration of the inherent short-term stability of this type of reactor and the long-term transient instability that results unless external control is employed. (auth)

4936

REACTOR PARAMETERS OF A LIGHT WATER—NORMAL URANIUM LATTICE. H. Kouts, G. Price, K. Downes, R. Sher, and V. Walsh (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy 2, 141(1955) Dec.

Measurements were made of the buckling, fast neutron effect, and thermal utilization of a sub-critical lattice consisting of 1.1-in. normal U rods, clad in Al, and immersed in light water. (B.J.H.)

4937

HEAT TRANSFER IN REACTORS COOLED AND MODERATED BY WATER. M. Altman (General Electric Co., Schenectady, N. Y.). Nucleonics 14, No. 2, 66, 68-73(1956) Feb.

Basic problems of heat transfer in reactors cooled and moderated by water are described to acquaint designers with these key factors in reactor design. Emphasis is placed on frontiers of heat-transfer reactor technology rather than on detailed information. Suggestions are made concerning factors needing clearer definition. (auth)

4938

NUCLEAR REACTOR DATA. Waltham, Mass., Raytheon Manufacturing Co., 1955. 17p. $0.50.

An information chart on all known reactor projects throughout the world has been compiled. Types of reactors listed include pressurized water, boiling water, swimming pool, homogeneous, heavy water, graphite, sodium graphite, liquid metal cooled, liquid fuel, and fast breeder. All the basic data available are given for each reactor. (D.E.B.)

4939

CONTROL EQUIPMENT FOR NEW BRITISH REACTOR. HOBSON-A.E.R.E. CONTROL SYSTEM FOR THE HARWELL TYPE E.443 REACTOR. Atomics 7, 5-8(1956) Jan.

Control equipment for the E.443 Reactor, a U^{235}, D_2O-cooled and moderated reactor of 10-Mw heat output is described. (D.E.B.)

4940

TWO-GROUP DIFFUSION IN SLAB LATTICE REACTORS. Frank B. Estabrook (North American Aviation, Inc., Downey, Calif.). J. Appl. Phys. 27, 175-8(1956) Feb.

Criticality calculations for heterogeneous reactor media are usually based on a single-cell calculation of f, the thermal utilization, followed by a "homogenized" treatment of the macroscopic neutron migration. A changed approach is here advocated, in which diffusion theory is applied only to the multiply-connected moderator portions of the reactor, the fuel is treated by the use of multiplying boundary conditions, and no arbitrary averaging need be done. As an example, the one-dimensional case of plane fuel slabs in moderator is treated, and the material buckling characteristic of the fundamental mode is obtained using two-group theory. The equation for this case readily allows a comparison between neutron migration lengths parallel to and perpendicular to the fuel slabs; considerable anistropy is found, in magnitude greatly dependent on fuel slab separation. (auth)

Refer also to abstracts 4505, 4556, and 4603.

NUCLEAR TRANSFORMATION

4941

ANGULAR DISTRIBUTION OF FRAGMENTS IN URANIUM 238 FISSION INDUCED BY NEUTRONS OF VARIOUS ENERGIES. A. A. Varfolomeev, A. S. Romantseva and V. M. Kutukova. Doklady Akad. Nauk S.S.S.R. 105, 693-5(1955) Dec. 1. (In Russian)

Dependencies of the fission fragment anisotropy on the energy of the fission inducing particles are studied for the purpose of establishing the mechanism of fission. The angular distributions of fission fragments of the natural uranium isotope mixture, induced by neutrons with the energy range of ~4, 12, 14, and 17 Mev, were studied. Also, the angular distribution of the U^{235} fragments, induced by thermal neutrons, was measured. (R.V.J.)

4942

STUDIES OF (γ,p) REACTIONS IN THE ENERGY RANGE UP TO 30 MEV. E. M. Leikin, R. M. Osokina, and B. S. Ratner. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 607 (1955) Sept.-Oct. (In Russian)

Detailed investigations of the energy and angular distribution of photoprotons in a series of elements were made with the 30-Mev synchrotron. The photoproton emission from copper was studied at γ quantum maximum energies of 19, 24, 28, and 30.5 Mev, and the emission from nickel

at 21.5, 25.5, 28.0 Mev. The preliminary measurements were obtained on aluminum and lead. With the transitions of $E\gamma_m$ = 24.0 Mev to $E\gamma_m$ = 28.0 and 30.5 Mev a sharp change was observed in the angular distribution, in the shape of the energy spectra, and the emission of the fast photoprotons from copper. (R.V.J.)

4943

THE EXCITATION CURVES OF SOME (n,p) PROCESSES INDUCED BY NEUTRONS OF 12.5–17.5 MEV ENERGY. A. V. Cohen and P. H. White (Imperial Coll. of Tech., London). Nuclear Phys. 1, No. 2, 73-84(1956).

The excitation functions of the reactions Mg^{24} (n,p), Si^{28} (n,p), Cl^{37} (n,p), Sr^{88} (n,p), Cu^{63} (n,2n) and Zn^{64} (n,2n) have been measured, using neutrons of energies between 12.5 Mev and 17.5 Mev from the T(d,n) reaction. The significance of the results is discussed from the viewpoint both of the theory of the compound nucleus and a theory of direct interaction. (auth)

4944

AVERAGE CROSS-SECTIONS FOR THE REACTIONS $^{32}S(n,p)^{32}P$ AND $^{31}P(n,p)^{31}Si$ WITH FISSION NEUTRONS. B. Grimeland (Inst. of Nuclear Science "Boris Kidrich", Belgrade). Nuovo cimento (10) 2, 1336-9(1955) Dec. (In English)

Calculations of the average cross sections of the $S^{32}(n,p)P^{32}$ and $P^{31}(n,p)Si^{31}$ reactions were made and compared to the experimentally determined values. (B.J.H.)

4945

ALPHA-GAMMA REACTION. H. Morinaga (Purdue Univ., Lafayette, Ind.). Phys. Rev. 101, 100-2(1956) Jan. 1.

The cross section of the reaction $Ni^{58}(\alpha,\gamma)Zn^{62}$ was measured as a function of the incident alpha-particle energy from ~10 to 17 Mev. The cross section at 17 Mev is about 0.4 mb and decreases gradually with decreasing energy. The experimental curve is compared with calculations assuming the formation of the compound nucleus. Two different gamma-ray width formulas are used; one is Weisskopf's single-particle formula for electric dipole radiation, and the other is obtained from the known gamma-ray width derived from photonuclear absorption cross sections. The former has about the right order of magnitude at the middle of the range investigated but behaves quite differently from the experimental curve. The latter shows fairly good agreement with the experiment, indicating the existence of the giant resonance. A calculation is also made for the reaction $Ni^{60}(p,\gamma)Cu^{61}$ cross section and the results fit quite well again with the experimental cross section reported by B. L. Cohen et al., indicating the possibility of explaining the reaction cross section without the assumption of the "capture of the proton from the orbit." In both cases, the calculated values are too low at the high-energy side. This may be explained by some failure of the assumptions in the calculations. (auth)

4946

ANGULAR DISTRIBUTIONS OF DEUTERONS FROM (p,d) REACTIONS IN LIGHT NUCLEI. I. NITROGEN. K. G. Standing (Princeton Univ., N. J.). Phys. Rev. 101, 152-7 (1956) Jan. 1.

Deuterons have been observed from the reaction $N^{14}(p,d)N^{13}$, produced by 18.7-Mev protons. The deuterons were distinguished from proton background by a thin NaI crystal in a scintillation counter with the crystal thickness equal to the deuteron range. The angular distribution of deuterons to the N^{13} ground state was fitted by a curve calculated from Butler's theory for an angular momentum transfer $l_n = 1$. This shows that the ground states of N^{13} and N^{14} have opposite parity and is consistent with the assignment of 1+ to the N^{14} ground state. The reduced width for the ground state transition is in qualitative agreement with that calculated using an independent-particle shell model with some indication that the N^{14} ground state is largely a D state. The transition $N^{14}(p,d)N^{13*}$ to the first excited state of N^{13} was not observed. The experimental upper limits on its cross section give upper limits of a few percent probability for admixtures of the configurations p^8s^2 and p^8sd in the N^{14} ground state. Application to the lifetime of C^{14} is discussed. (auth)

4947

ANGULAR DISTRIBUTIONS OF DEUTERONS FROM (p,d) REACTIONS IN LIGHT NUCLEI. II. LITHIUM, BERYLLIUM, BORON, FLUORINE, AND ALUMINUM. J. B. Reynolds and K. G. Standing (Princeton Univ., N. J.). Phys. Rev. 101, 158-65(1956) Jan. 1.

Angular distributions of deuteron groups resulting from the bombardment of various elements with ~18-Mev protons have been observed. Angular distributions for reactions leading to the following final nuclei were studied: Li^6, Li^{6*} (2.2 Mev), Be^8, B^9, B^{9*} (2.4 Mev), B^{10}, F^{18}, Al^{26}. The observed data are fitted to theoretical (Butler) curves and in all cases, except F^{18} and Al^{26}, l_n (the angular momentum carried away by the picked up neutron) is found to be unity. For F^{18} and Al^{26}, l_n is found to be 0 and 2, respectively. Absolute cross-section measurements for some of the reactions are given and are compared with theory. (auth)

4948

NUCLEAR REACTIONS PRODUCED BY NITROGEN ON NITROGEN. H. L. Reynolds and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 166-71(1956) Jan. 1.

Excitation functions for the reactions (1) $N^{14}(N^{14}, N^{13})N^{15}$ and (2) $N^{14}(N^{14}, O^{15})C^{13}$ were determined from thick-target yields obtained with 26-Mev nitrogen ions on AgCN. The cross section for both reactions at 25 Mev is about 5 millibarns. As the energy decreases, the cross section for reaction (1) decreases more rapidly than for reaction (2). Neither N^{13} nor O^{15} was observed from the proton bombardment of Al^{27} at proton energies which lead to the same excitation in the compound nucleus. Further, it was found that reaction (1) proceeds through the ground states of N^{13} and N^{15} in more than 90% of the cases. The angular distribution of N^{13} in reaction (1) was measured for nitrogen energies of 16.3, 19.2, 21.1, and 23.3 Mev. The peak of the distribution at 23 Mev is at 50 deg in the center-of-mass system. As the energy decreases, the angle at which the peak occurs increases. It is concluded that these reactions take place through a stripping process. (auth)

4949

MAGNETIC SPECTROGRAPH MEASUREMENTS ON THE $Al^{27}(d,p)Al^{28}$ REACTION. W. W. Buechner, M. Mazari, and A. Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 188-95(1956) Jan. 1.

A broad-range magnetic spectrograph has been used to study the proton groups from $Al^{27}(d,p)Al^{28}$. In the region of excitation between the ground state and the neutron binding in Al^{28}, one hundred well-resolved groups were observed and assigned to this reaction on the basis of studies at bombarding energies of 6 and 7 Mev and at several angles of observation. The energy resolution of the proton groups ranged from 800 to 1600. (auth)

4950

CROSS SECTION AND ANGULAR DISTRIBUTIONS OF THE (d,p) AND (d,n) REACTIONS IN C^{12} FROM 1.8 TO 6.1 MEV. T. W. Bonner, J. T. Eisinger, Alfred A. Kraus, Jr., and J. B. Marion (Rice Inst., Houston, Tex.). Phys. Rev. 101, 209-13(1956) Jan. 1.

The reaction $C^{12}(d,p)C^{13}$ has been studied from a deuteron bombarding energy of 1.8 to 6.1 Mev. Resonances were found at 2.47, 2.67, 2.99, 3.39, 4.00, 4.6, 4.8, 5.34, and 5.64 Mev. Angular distributions of protons leaving

C^{13} in the ground state show a pronounced Butler peak at 25° over the entire deuteron energy range. The angular distributions can be explained by assuming small amplitudes for compound nucleus formation interfering with large stripping amplitudes. Angular distributions of the lower energy group of protons leaving C^{13} excited to 3.09 Mev show a pronounced Butler peak at 0° and an even smaller contribution of compound nucleus formation. The reaction $C^{12}(d,n)N^{13}$ was also studied, and showed similar resonances and angular distributions. An analysis is made of the phase difference between the resonant and nonresonant parts of the cross section for the (d,p) reaction near the resonance at 4.00 Mev. (auth)

4951

ALPHA EXCITATION FUNCTIONS OF SILVER AND COPPER. Karl G. Porges (Univ. of California, Berkeley). Phys. Rev. 101, 225-30(1956) Jan. 1.

The excitation functions for the production of some of the nuclei formed by alpha-particle bombardment of copper and silver have been measured for alpha energies up to 40 Mev. Comparison of these data with theoretical predictions based on (a) the assumption of relatively large radius constants (r_0 = 1.5 for Zn, r_0 = 1.65 for Cd) and (b) an energy-dependent odd-odd to even-even level density ratio allows two conclusions: (1) (α,pn) cross sections are in good agreement with predictions based on the statistical theory. This lends some support to the proposal that the large (p,p), (p,pn), (n,p) etc., cross sections recently reported are primarily due to direct interactions. (2) With an energy level density $\omega = C \exp 2(aE)^{1/2}$, calculations based on the values of a deduced from inelastic scattering experiments do not fit the experimental curves; a derived from measured level spacing agrees with the copper, but not with the silver data. The best fit for the silver gives a ~2. This result, similar to that obtained by the analysis of other experimental data, suggests that there is a considerable excess of high-energy evaporated particles. (auth)

4952

REACTION $Li^6(p,\gamma)Be^7$. J. B. Warren, T. K. Alexander, and G. B. Chadwick (Univ. of British Columbia, Vancouver). Phys. Rev. 101, 242-5(1956) Jan. 1.

The reaction $Li^6(p,\gamma)Be^7$ has been investigated by using protons of energy 0.4 to 1 Mev incident on isotopically separated Li^6 targets. Capture gamma radiation to the ground state and the 430-kev state in Be^7 has been observed; some 62% of the transitions go to the ground state. The ratio of intensities does not change significantly with energy, nor with angle of observation at E_p = 750 kev. The differential cross section with the counter at 90° and E_p = 750 kev is about 2×10^{-32} cm²/steradian. The combined angular distribution of the two gamma rays is $1 + (1.05 \pm 0.15)\cos^2\theta$ at E_p = 750 kev. The Q value for the reaction is 5.66 ± 0.03 Mev in agreement with that calculated from mass values. (auth)

4953

CROSS SECTION FOR THE $Si^{28}(n,p)Al^{28}$ REACTION. J. B. Marion, R. M. Brugger, and R. A. Chapman (Rice Inst., Houston, Tex.). Phys. Rev. 101, 247-9(1956) Jan. 1.

By observing the radioactivity induced in glass samples bombarded by monoenergetic neutrons from the d-d reaction, the excitation function and the absolute cross section for the $Si^{28}(n,p)Al^{28}$ reaction have been measured for neutron energies from 4.4 to 8.0 Mev. In this energy region several resonances were found and the maximum cross section was measured to be 0.37 barn. (auth)

4954

$C^{12}(x,xn)C^{11}$ AND $Al^{27}(x,x2pn)Na^{24}$ CROSS SECTIONS AT HIGH ENERGIES. Walter E. Crandall, George P. Millburn, Robert V. Pyle, and Wallace Birnbaum (Univ. of California, Berkeley). Phys. Rev. 101, 329-37(1956) Jan. 1.

The $C^{12}(x,xn)C^{11}$ and $Al^{27}(x,x2pn)Na^{24}$ cross sections were measured for protons (105 to 350 Mev), deuterons (85 to 190 Mev), and alpha particles (380 Mev) by using a $4\pi\beta$ counter to determine the absolute disintegration rate and measuring the incident flux with a Faraday cup. The absolute value of the $C^{12}(p,pn)C^{11}$ excitation function was found to be 13% lower than the value previously published for these energies, and was found to be constant between 200 and 350 Mev. The new value of this reaction cross section removes some of the discrepancies between p-p scattering cross sections measured elsewhere and those measured at Berkeley, and affects other experiments that use the reaction as a proton flux monitor. The other cross sections are in reasonable agreement with values determined by comparable methods. The relative excitation functions for $C^{12}(d,dn)C^{11}$ and $C^{12}(He^3, He^3n)C^{11}$ reactions were also measured by a stacked-foil technique using end-window counters. These were normalized to absolute values from the 4π counter data for deuterons. (auth)

4955

PHOTODISSOCIATION OF THE DEUTERON FROM 150 TO 450 MEV. J. C. Keck and A. V. Tollestrup (California Inst. of Tech., Pasadena). Phys. Rev. 101, 360-70(1956) Jan. 1.

The photodissociation of the deuteron has been investigated for laboratory photon energies of 150, 200, 250, 300, 350, 400, and 450 Mev at laboratory angles of 39, 56, 74, 93, 115, and 138 degrees. The process was identified by detecting the recoil protons in a range-ionization telescope. The total cross section has a relative minimum at 150 Mev followed by a relative maximum at 250 Mev where its values are 53×10^{-30} cm² and 63×10^{-30} cm², respectively. From 150 to 250 Mev the center-of-momentum angular distributions have a strong forward maximum which diminishes at higher energies until the distributions become approximately symmetrical. There is qualitative agreement with meson theories on some points. (auth)

4956

PHOTODISINTEGRATION OF THE DEUTERON. Fredrik Zachariasen (California Inst. of Tech., Pasadena). Phys. Rev. 101, 371-6(1956) Jan. 1.

The Chew meson theory has been applied in an attempt to describe the photodisintegration of the deuteron in the region of 100 to 400 Mev, and in particular to explain the appearance of a sort of resonance at about 250 Mev. The process is viewed as a meson photoproduction, followed by meson scattering in deuterium (treated in the impulse approximation) and absorption. The qualitative features of total cross section are roughly reproduced, but the angular distribution does not seem to be fully understood on this model. (auth)

4957

PHOTODISINTEGRATION OF DEUTERIUM BY 60- TO 250-MEV X-RAYS. E. A. Whalin, Barbara Dwight Schriever, and A. O. Hanson (Univ. of Illinois, Urbana). Phys. Rev. 101, 377-84(1956) Jan. 1.

A liquid deuterium target was irradiated with x rays from the University of Illinois 300-Mev betatron. Exposures were made at maximum bremsstrahlung energies of 165 Mev, 280 Mev, 280 Mev, and 300 Mev. The photoprotons produced were detected with Ilford G-5 nuclear emulsions. The distributions of protons as functions of energy were determined for laboratory angles of 30°, 45°, 75°, 120°, and 150°. In the energy region from 60 Mev to 250 Mev the angular distributions are relatively flat but have considerable fore and aft asymmetries. The total cross

section, which was found not to vary greatly over this entire energy region, has a broad minimum of about 55 microbarns in the region of 150 Mev. (auth)

4958

RECOIL STUDIES OF HIGH-ENERGY PROTON REACTIONS IN BISMUTH. Nathan Sugarman (Univ. of Chicago and Brookhaven National Lab., Upton, N. Y.) and Milton Campos and Karoline Wielgoz (Univ. of Chicago). Phys. Rev. 101, 388-97(1956) Jan. 1.

The ranges in bismuth of Sr^{91}, Ba^{129}, and Ba^{133m} recoil fragments from bombardment of bismuth with protons of 50 Mev to 2.2 Bev have been measured. The kinetic energies of the fragments have been calculated from the measured ranges and other reported range-energy data for fission fragments. The kinetic energy of the strontium recoils for all energies, and that of the barium recoils up to 450 Mev, can be explained as resulting from high-energy fission where most of the mass of the target is divided between two heavy fragments. At 2.2 Bev, the kinetic energy of the bariums recoils is substantially smaller, consistent with a complimentary fragment of about 20 mass units. The energy deposition in the target nucleus for processes leading to strontium and barium nuclides was obtained from the ratio of recoils projected forward to those projected backward, and subsidiary calculations involving momentum and energy conservation. The calculated values of the energy deposited are substantially lower than the bombarding proton energies and even somewhat lower than energy values calculated for production of the "fissioning nucleus" from radiochemical data. Recoil experiments on spallation products, bismuth, lead, and thallium, of masses 198 to 203, from high-energy proton bombardment of bismuth, indicate that thallium nuclides formed directly are produced in processes involving alpha-particle emission. (auth)

Refer also to abstract 4853.

PARTICLE ACCELERATORS

4959 CEA-350

France. Commissariat à L'Énergie Atomique, Paris.

UN TUBE D'ACCELERATION CONTINUE D'IONS SOUS 200 KV. (A Tube for Continuous Acceleration of Ions Under 200 KV). G. Mongodin. 1954. 82p.

Detailed descriptions are given of an accelerator tube for ions under 200 kv. The performance of the ion source and the corpuscular optics of the accelerator tube are also discussed. Calculations were also made of the currents in the tube. Electrical breakdowns in the tube are briefly considered. (B.J.H.)

4960

CONTINUAL INJECTION INTO CIRCULAR ION ACCELERATORS. Lee C. Teng (Argonne National Lab., Lemont, Ill.) Rev. Sci. Instr. 27, 106-7(1956) Feb.

Continual injection of ions into a fixed-field circular accelerator with either weak or strong focusing magnetic fields can be accomplished by using an inversely operating magnetic regenerative deflector. This is seen as a method of increasing the beam intensity of high-energy accelerators. (D.E.B.)

4961

ON SOME ANTISYMMETRICAL MAGNETIC FIELDS WITH DOUBLE FOCUSING. Yu. V. Vandakurov. Zhur. Tekh. Fiz. 25, 2545-55(1955) Dec. (In Russian)

Equations were obtained for antisymmetrical fields with symmetrical rotation, producing double focusing of charged particle paraxial beams. The field character depends on the direction and initial radius of the beam axis trajectory which lies in the middle of the field plane. Calculations were made of focal points, magnification, dispersion, and aberration for some values of these parameters. The possibility of realizing double focusing in antisymmetrical fields, independent from a single Descartes coordinate was investigated. (tr-auth)

4962

SHUNT RESISTANCE OF LINEAR ACCELERATORS. Wassek Chahid. Compt. rend. 242, 244-7(1956) Jan. 9. (In French)

Equations are derived for the calculation of the shunt resistance of linear accelerators. (B.J.H.)

4963

SYNCHROTRON OSCILLATIONS IN STRONG-FOCUSING ACCELERATORS. (LINEAR THEORY). L. L. Goldin and D. G. Koskarev (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 2, 1251-68(1955) Dec. (In English)

Equations describing synchrotron oscillations in strong-focusing accelerators are deduced and solved. In deriving them, it was taken into account that the accelerating field frequency is automatically connected with the magnetic field intensity. A general solution for oscillations both in the adiabatic and critical regions has been found, and respective integrals of motion have been obtained. It is shown that motion in the critical region may be simply represented by the effective frequency of oscillation. The paper investigates the influence of the fluctuations, ripples and noise of the frequency and amplitude of the accelerating voltage, and magnetic field. Computation formulas are given for respective tolerances. (auth)

4964

ON THE EFFECT OF MAGNETIC FIELD ERRORS ON THE BETATRON OSCILLATIONS IN THE STRONG-FOCUSING SYNCHROTRON. G. Lüders (Max-Planck-Institut für Physik, Gottingen, Germany). Nuovo cimento (10) 2, Suppl. No. 4, 1075-1146(1955). (In German)

RADIATION ABSORPTION AND SCATTERING

4965 AERE-T/R-1791

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SCATTERING OF POLARIZED NUCLEONS BY NUCLEI. F. C. Barker. Nov. 1955. 25p.

Equations for calculating the asymmetry in scattering of high-energy polarized nucleons by nuclei are given, and the validity and utility of approximate methods of calculation are discussed. (auth)

4966 CF-54-11-83

Oak Ridge National Lab., Tenn.

ANISOTROPIC SCATTERING OF NEUTRONS IN A UNIFORM MEDIUM WITH BEAM SOURCES. F. H. Murray. Dec. 3, 1954. 16p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

A brief derivation is given of formulas useful in the analysis of problems of multiple scattering of neutrons in an unbounded medium. These formulas may be used in some problems of scattering in stratified media. The particle velocity is assumed constant in the analysis, but for media with constant cross sections a Laplace transformation applied to the Boltzmann equation reduces the general problem to this case, at the expense of introducing determinants of large order. The scattering law is assumed to depend only on the angle between the initial and final directions of the scattered particle. Some formulas obtained by Grosjean appear as special cases of this analysis, which is based directly on the Fourier transform. The spacial distribution of sources and the intensity as a function of angle from any point is arbitrary. (auth)

4967 CF-55-9-108

[Oak Ridge National Lab., Tenn.]

INTEGRAL EQUATIONS FOR THE FLUX DENSITY NEAR A THIN FOIL AND FOR SCATTERING IN AIR IN THE PRESENCE OF THE GROUND. F. H. Murray. Sept. 23, 1955. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4968

ON THE SCATTERING THEORY OF DIRAC PARTICLES CONSIDERING THE ATTENUATION. A. A. Sokolov and B. K. Kerimov. (Lomonosov Moscow State Univ.) Doklady Akad. Nauk S.S.S.R. 105, 961-4(1955) Dec. 11. (In Russian)

The method of attenuation was used to solve the problem of Dirac particle elastic scatterings induced by a central force. The vacuum terms, and the terms describing bremsstrahlung are not considered in the study. (R.V.J.)

4969

ON THE THEORY OF X RAY SCATTERING BY MACROSCOPIC ISOTROPIC BODIES. V. N. Filipovich and E. A. Poral-Koshits. (Inst. of Silicate Chemistry) Doklady Akad. Nauk S.S.S.R. 105, 968-71(1955) Dec. 11. (In Russian)

A new analytical equation is developed for Fourier roentgenogram of macroisotropic bodies (gases, liquids, glasses, amorphic bodies, and polycrystals) to clarify the physical sense of W(r), the radial distribution of atoms. The evaluation of the errors, made in previous work, on determining the curves of radial distribution, are discussed. (R.V.J.)

4970

PHASE SHIFT ANALYSIS OF PROTON-PROTON SCATTERING EXPERIMENTS. I. GENERAL FORMULATION. E. Clementel and C. Villi (Univ. of Padua and Trieste and National Inst. of Nuclear Physics, Padua). Nuovo cimento (10) 2, 1165-82(1955) Dec. (In English)

The phase shift analysis problem of proton-proton scattering experiments is considered. In the approximation of S and P waves, a parametrization method is given by which the four phase shifts for the singlet S and the triplet P state can be derived. If the contribution of D waves and the effect of the coupling $^3P_2-^3F_2$ is included, it is shown that the problem can still be solved by resorting to a polynomial method. (auth)

4971

ELASTIC NUCLEAR COLLISIONS OF 1 MEV ELECTRONS IN ARGON. A. Lovati and C. Succi (Univ. of Milan and National Inst. of Nuclear Physics, Milan). Nuovo cimento (10) 2, 1224-33(1955) Dec. (In Italian)

The elastic scattering of 1-Mev electrons has been analyzed by means of a diffusion cloud chamber filled with argon at atmospheric pressure. A total length of 2157 m was measured in about 10,000 photographs, collected in 50 hours. The total number of scatterings $\geq 20°$ is 739, with 56 deflections greater than 50°. The ratio between the experimental and the theoretical total cross section for angles $\geq 50°$ is 1.02 according to Mott's prediction and 0.84 according to Rutherford's theory. The analysis of the differential cross sections shows that the formula of Mott is in better agreement with the experimental results than the formula of Rutherford. (auth)

4972

THE SCATTERING OF PROTONS WITH ENERGIES 460-660 MEV ON PROTONS. S. Ya Nikitin, Ya M. Selector, E. G. Bogomolov, and S. M. Zombkouskii (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 2, 1269-81(1955) Dec. (In English)

(p-p) scattering is studied with protons obtained from the synchrocyclotron of the Institute for Nuclear Problems of the Academy of Sciences of the USSR. The scattering cross section and the angular distribution have been measured in the interval of energies from 460 up to 660 Mev. The results show that practically up to proton energies of 460 Mev the scattering cross section is isotropic, in the interval 560 to 660 Mev it is markedly anisotropic. A discussion of the results obtained is given. (auth)

4973

ON THE INELASTIC MEAN FREE PATH OF 450 MEV PROTONS IN NUCLEAR EMULSIONS. V. Benzi, M. Ladu, and N. Marongiu (Univ. of Cagliari). Nuovo cimento (10) 2, 1317-19(1955) Dec. (In Italian)

4974

ELASTIC SCATTERING OF GAMMA RAYS. A. K. Mann (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 101, 4-8(1956) Jan. 1.

Gamma rays of 0.411, 0.662, and 1.33 Mev were scattered from tin and lead targets, and the absolute differential cross sections for elastic scattering were measured at six angles between 15 and 90 degress. At 0.411 and 0.662 Mev, the scattering is expected to be almost entirely Rayleigh scattering from the tightly bound electrons, and these data should therefore provide a reasonably stringent test of the theory of that process. However, the only calculations of Rayleigh scattering presently available are form-factor calculations which are expected to be inadequate for several reasons—in particular, for neglect of electron binding in the intermediate state of the scattering process, and for certain nonrelativistic approximations—and consequently comparisons of experiment with the form-factor results are inconclusive. Nevertheless, for the scattering from tin at both 0.411 and 0.662 Mev, there is fair but possibly fortuitous agreement between experiment and form-factor calculations using Dirac wave functions for the electrons; for lead at the same energies there are appreciable discrepancies particularly at the larger angles between the experimental results and similar calculations. In view of the latter discrepancies, it appears that unambiguous identification of the elastic scattering of gamma rays by the electric field of a nucleus, i.e., potential scattering, cannot be obtained from measurements of the total elastic scattering by lead at 1.33 Mev without improvements in the theory of Rayleigh scattering. (auth)

4975

STATISTICAL APPROACH TO COLLISION PROCESSES: APPLICATION TO ATOMIC EXCITATION. Robert W. Hart, Ernest P. Gray, and William H. Guier (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev. 101, 84-92(1956) Jan. 1.

A statistical description is developed for collision phenomena such as atomic excitation, where it is important to recognize that the motion of the bound and free particles is ordered, rather than chaotic. This is accomplished by using the concept of a collision complex which is permitted to decay only into final states of ordered motion in which conservation of the initial energy and angular momentum would allow the system to be found long after collision. A major feature of this approach is that, while it deals with ordered motion exclusively, the interparticle interaction does not appear explicitly, but is implied by the formation of the complex and by the usual assumption in statistical mechanics that it is the mechanism for establishing a uniform distribution in the accessible phase space. The theory is applied in a semiclassical form to the single excitation of atoms by electron impact. Cross sections for H and He are compared with the Born approximation and for He with experimental data. (auth)

4976

ELASTIC SCATTERING OF PROTONS FROM Li^7. Philip

R. Malmberg (State Univ. of Iowa, Iowa City). Phys. Rev. 101, 114-18(1956) Jan. 1.

Differential cross sections for the elastic scattering of protons from Li^7 were measured over the energy range 1350 kev to 3000 kev at the center-of-mass angles 70°, 90°, 110°, 130°, 150°, and 167°. The various proton groups scattered from different elements in the lithium target and target backing were separated by a magnetic analyzer. The 167° data agreed well with the earlier work at 166.3° by Bashkin and Richards. At all six angles the curves showed a maximum at about 2000 kev, a dip at 2230 kev, and an anomaly near the 1882 kev $Li^7(p,n)Be^7$ threshold. Exclusive of the anomaly, the energy dependence of the data suggests the presence of two interfering levels in Be^8. (auth)

4977

INTERACTIONS OF 380-MEV ALPHA PARTICLES IN NUCLEAR TRACK EMULSION. Dora Sherman Willoughby (Univ. of California, Berkeley). Phys. Rev. 101, 324-8 (1956) Jan. 1.

A study has been made of stars produced by 380-Mev alpha particles in Ilford G.5 emulsion. The mean free path for star production is 18.4 ± 0.9 cm. The number of prongs per star varies from one to eight. The average number of prongs per star is 3.3. The striking feature of these stars is stripping, or splitting of the incident alpha particle. This is evident in the large number of two-prong stars in which both prongs emerge with high energy at small angles to the beam direction; in the presence of one-prong stars, in which the single prong is a fast proton or deuteron emerging in nearly the forward direction; and in the very narrow angular distribution of the fast prongs. The star prongs have been divided into two groups, one group consisting almost entirely of cascade prongs, and the other consisting predominantly of evaporation prongs. The properties of the two groups of prongs are examined. It is found that the excitation produced by alpha particles is similar to that produced by protons of the same energy, but the cascade differs in important respects. By observing the stars with prongs of energy lower than is necessary to escape the barrier of a heavy nucleus, one can identify 27% of the stars as originating in light nuclei. This places a lower limit on the number of events occurring in the gelatin. (auth)

4978

COULOMB INTERFERENCE IN HIGH-ENERGY PROTON-PROTON SCATTERING. A. Garren (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 101, 419-23(1956) Jan. 1.

The use of Coulomb interference in the phase-shift analysis of p–p scattering is considered. To this end the Coulomb amplitude is calculated relativistically in the Born approximation, using a static anomalous magnetic moment. This amplitude is used to obtain formulas for the Coulomb interference contribution to the cross section and polarization. An application to the phase-shift analysis of the 200-Mev data is discussed. (auth)

4979

CHARGE INDEPENDENCE AND POLARIZATION EXPERIMENTS. L. Wolfenstein (Univ. of California, Berkeley and Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 101, 427-8(1956) Jan. 1.

Change independence is applied to experimental data on n-p and p-p scattering around 300 Mev. Results are deduced for the cross section and polarization for the nucleon-nucleon scattering with total isotopic spin zero. (auth)

4980

REFLECTION AND TRANSMISSION OF GAMMA RADIATION BY BARRIERS: MONTE CARLO CALCULATION BY A COLLISION-DENSITY METHOD. Martin J. Berger. J. Research Natl. Bur. Standards 55, 343-50(1955) Dec.

The collision density of photons in an infinite Compton-scattering medium was calculated by random sampling. The intensity, spectral composition, and angular distribution were then determined for radiation reflected and transmitted by plane-parallel barriers by carrying out appropriate integrations over the collision density, taking into account the absorbing properties of the medium and the effect of boundaries. All numerical work was done on the NBS automatic computer (SEAC). Sample results are presented for 0.66-Mev radiation incident on water barriers of various thicknesses. (auth)

4981

EXPERIMENTAL RELATIONSHIP BETWEEN THE RANGE AND ENERGY OF NITROGEN IONS IN NUCLEAR EMULSIONS FOR ENERGIES BETWEEN 10 AND 100 MEV. Robert Chaminade, Monique Crut, Henriette Faraggi, Arlette Garin-Bonnet, Jeanine Olkowsky, and Andre Papineau. Compt. rend. 242, 105-8(1956) Jan. 4. (In French)

The ion energies are defined by the curvature of their trajectories in the magnetic field of the cyclotron and the ranges were measured in Ilford C-2 emulsions. (tr-auth)

4982

SCATTERING OF PROTONS BY PROTONS AT 460 TO 660 MEV. S. Ya. Nikitin, Ya. M. Selector, E. G. Bogomolov, and S. M. Zombkovskiĭ. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 561-72(1955) Sept.-Oct. (In Russian)

Investigations of p-p scattering were carried out with the synchrocyclotron of the Inst. of Nuclear Problems. Protons of 460 and 660 Mev were obtained directly from the accelerator; protons of 560 Mev were obtained by retarding the 660-Mev protons in the graphite filters. (R.V.J.)

4983

THE ELASTIC AND INELASTIC SCATTERING OF FAST NEUTRONS. I. W. D. Allen (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 26-9, 37(1956) Jan.

Studies of the variation of total cross section with energy have shown that the cross sections of neighboring elements are similar, and that the cross sections, instead of steadily decreasing with energy, show broad "resonances". These resonances have been explained with striking success by Weisskopf in his quasi-optical, or complex potential model. This model has also been reasonably successful in explaining the variation of angular distribution of elastically scattered neutrons at 1 Mev. Studies of inelastically scattered neutrons show promise, but depend more on the development of satisfactory techniques. The techniques, the results obtained with them, and the theory which accounts for the results, are briefly described in the following articles. (auth)

4984

SOURCE-STRAGGLING OF α-PARTICLES FROM A POLONIUM SOURCE. N. K. Saha and K. L. Kaila (Univ. of Delhi, India). Indian J. Phys. 29, 417-28(1955) Sept.

By using a Lindemann electrometer in conjunction with a high megohm resistor and a shallow ionisation chamber, complete Bragg curves are obtained for Po α particles freshly separated from some old radon tubes and for a second source about 29 months old. The latter shows by comparison a very distorted Bragg curve with its tail portion spread about 1 cm. air beyond the maximum. The speed is interpreted as the superposition effect of a large number of separate ideal Bragg curves arising due to the finite source depth accumulated through aging. A theoretical formula is developed taking into account the straggling due to the source depth as well as the well known Gaussian

law of range straggling. The calculated results show good agreement with the observed Bragg curve. (auth)

Refer also to abstracts 4744, 4821, 4832, 4835, 4850, 4851, 4852, 5012, and 5019.

RADIATION EFFECTS

4985 KAPL-1455

Knolls Atomic Power Lab., Schenectady, N. Y.

IRRADIATION OF GERMANIUM BY FAST MONOENERGETIC NEUTRONS. J. W. Moyer, W. A. Smith, Jr., and O. L. Cunningham. May 25, 1956. 33p. Contract W-31-109-Eng-52. $0.30(OTS).

The effect of monoenergetic fast neutrons (from a Van de Graaff accelerator) upon the electrical resistivity and the Hall coefficient of different germanium materials was studied. Significant changes in carrier concentrations were observed in the case of the gold-doped materials. The observed increases of carrier concentration in the p-type gold-doped germanium samples were contrary to the changes caused by higher integrated fluxes of fast neutrons from a pile source. Further experiments are planned. (auth)

4986 ORNL-1700

Oak Ridge National Lab., Tenn.

EFFECT OF RADIATION ON THE DIELECTRIC CONSTANT AND ATTENUATION OF TWO COAXIAL CABLES. R. A. Weeks and D. Binder. Mar. 19, 1954. Decl. Feb. 23, 1955. 16p. Contract W-7405-eng-26. $0.20(OTS).

Measurements have been made on radiation induced changes in the phase constant and attenuation of two coaxial cables while being irradiated. The measurements were made in the region of four megacycles. At this frequency the change in dielectric constant was (1.4 ± 0.4) % for both dielectrics after roughly 2×10^{18} nvt. The change in attenuation was (9 ± 2) % for polyethylene and within the range of error for teflon. The phase constant and attenuation were found by measuring the input impedance of an open-ended length of cable in the neighborhood of its quarter-wave frequency. Assuming a uniform cable dielectric and no other variables the input impedance has a minimum at this frequency. From the minimum the attenuation and phase constant are found. (auth)

4987 WAPD-RM-122

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE CONDUCTIVITY CHANGE IN GOOD INSULATORS DURING γ-IRRADIATION. THE CONDUCTIVITY OF TEFLON. Sumner Mayburg. May 1, 1952. 12p. Contract AT-11-1-GEN-14. $0.15(OTS).

On the basis of measurements on Teflon one expects that the d-c conductivity σ produced in good insulators by γ irradiation depends on the γ-ray intensity I by the relation $\sigma \sim I^n$ where n is ½ for high values of intensity and low electric fields and n is 1 for low γ-intensities and high electric fields. (auth)

4988

STUDY OF THE MACROSCOPIC EXPANSION OF GRAPHITE BY IRRADIATION. Jean-Loup Delcroix and Jacques Yvon. Compt. rend. 242, 628-30(1956) Jan. 30. (In French)

The irradiation of two samples of graphite gave expansions, $(\Delta e/e_0)$ of 10^{-23} and 1.6×10^{-23}/fast neutron/cm^2. An attempt was made to compare these results with those obtained in other countries. (tr-auth)

4989

ON THE LIGHT EMITTED DURING THE IRRADIATION OF AQUEOUS MEDIA WITH α-PARTICLES. L. O. Brown and N. Miller (Edinburgh Univ., Scotland). Trans. Faraday Soc. 51, 1623-32(1955) Dec.

From the absence of any detectable emission of light from H_2O or H_2O vapor irradiated with α particles, and from a study of the luminosity of α-ray irradiated aqueous solutions of sodium salicylate as a function of concentration, it is concluded that the greater part of the energy of the α particles which is not used in ionization is expended in exciting water molecules to their lowest singlet state. This state is known to lead to dissociation, the products of dissociation being presumably H atoms and OH radicals. The consequences of this conclusion for the radiation chemistry of water are examined. (auth)

4990

DEPENDENCE OF YOUNG'S MODULUS AND INTERNAL FRICTION OF COPPER UPON NEUTRON BOMBARDMENT. Donald O. Thompson and David K. Holmes (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 27, 191-2(1956) Feb.

The functional dependence of Young's modulus and internal friction of Cu on neutron bombardment is reported. Preliminary results are consistent with J. S. Koehler's theory of the pinning of free lengths of dislocation lines by impurity atoms in that fast neutrons apparently pin the dislocation line segments also. Experimental and theoretical values are plotted for comparison. (D.E.B.)

Refer also to abstract 4737.

RADIOACTIVITY

4991 NM-001-059.18.03

Naval School of Aviation Medicine, Pensacola, Fla.

GRAPHICAL METHOD OF EVALUATING RADIATION FIELDS IN LARGE SCALE STORAGE OF GAMMA-ACTIVE OBJECTS. Hermann J. Schaefer. Nov. 20, 1954. 23p. (AD-56109).

In large-scale manufacture and storage of gamma-active objects the spatial arrangement of the radiation sources greatly influences the resulting intensity. Dissipation can substantially reduce the radiation hazard, but is costly at the same time. A method is described which simplifies the procedure of pre-calculating radiation fields of many point sources by substituting a line source for a linear array of n point sources. Charts and formulas are presented to aid in the practical application of the method. (auth)

4992 NRL-4484

Naval Research Lab., Washington, D. C.

SPECTRAL DISTRIBUTION OF RADIATION FROM CYLINDRICAL SOURCES. Interim Report. J. D. Plawchan, L. A. Beach, and W. R. Faust. Dec. 27, 1954. 5p. Project Nos. NR-664-020, NS-200-024, and NS-200-025. (AD-51807).

Spectral distributions of emergent radiation from thick cylindrical sources containing aqueous solutions of Co^{60} have been deduced from scintillation spectrometer pulse-height distributions. Spectra so obtained are typical of extended cylindrical sources. Utilization of such spectra in shielding computations may permit a more accurate determination to be made in cases involving sources whose dimensions are several mean free paths thick. (auth)

4993

DISINTEGRATION OF SELENIUM-73. R. W. Hayward and D. D. Hoppes (National Bureau of Standards, Washington, D. C.). Phys. Rev. 101, 93-7(1956) Jan. 1.

The radiations from the 7.1-hour Se^{73} activity have been investigated using magnetic lens, scintillation pulse-height, and coincidence counting techniques. Two gamma

rays of 65.8- and 359-kev energy and of nearly equal intensity are observed to be in prompt coincidence with each other and in delayed coincidence with annihilation radiation resulting from the positron decay of the Se^{73} parent. Energy and intensity measurements indicate that a main group (E_{max} = 1.29 Mev, log ft = 5.3) excites the gamma-ray cascade, while a weaker group (E_{max} = 1.65 Mev, log ft ≤ 8.0) excites the 65.8-kev transition only. These data coupled with internal conversion information lead to a level scheme in As^{73} as follows: ground level, $p_{3/2}$; 65.8-kev level, $f_{5/2}$; and 425-kev level, $g_{9/2}$, $\tau_{1/2}$ = 6 μsec. The 7.1-hour level in Se^{73} is in a $g_{9/2}$ state. (auth)

4994

GAMMA RAYS IN THE DECAY OF BARIUM-131. William C. Beggs, Berol. L. Robinson, and Richard W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev. 101, 149-52(1956) Jan. 1.

Gamma rays accompanying electron capture of 12-day Ba^{131} have been studied with a single-channel scintillation spectrometer. Relative intensities have been determined for the 122-kev (198), 214-kev (148), 372-kev (100), 496-kev plus satellite (360), and 620-kev (33) gamma rays. Three new gamma rays have been found at 823 ± 20 kev (2.0), 917 ± 15 kev (7.2), and 1032 ± 15 kev (11.0), and their assignment to Ba^{131} has been established by chemical purification and half-life. Crystal summing studies confirm that the 620-kev transition is the crossover of the 122-kev and 496-kev transitions, and no significant crystal summing is found for the three new gamma rays. A peak corresponding to 83 kev was observed, which appears to be due to two or more unresolved gamma rays, but no gamma ray could be found at 100 kev. The decay of Ba^{131} was followed for 9 half lives using an end-window beta proportional counter, and the half-life was found to be 11.52 ± 0.08 days. The ratio of the pile neutron cross section for the activation of Ba^{131} to that of long-lived Ba^{133} has been found to be $\sigma(Ba^{130})/\sigma(Ba^{132}) = 1.2 \pm 0.3$. (auth)

4995

DECAY OF RADIOACTIVE Ce^{143} (33.4 hr). D. W. Martin, M. K. Brice, J. M. Cork, and S. B. Burson (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 182-8(1956) Jan. 1.

The beta and gamma radiations of Ce^{143} have been studied with a ten-channel scintillation coincidence spectrometer, with a double-focusing magnetic spectrometer, and with photographic magnetic spectrographs. Five beta-ray components and ten gamma rays are identified with the activity, and the decay scheme is established involving six excited states of the daughter Pr^{143} nucleus. It is found that no beta rays of measurable intensity proceed directly to the Pr^{143} ground state. Spin and parity assignments are made for several of the levels. (auth)

4996

UNIQUE FIRST FORBIDDEN BETA SPECTRUM OF ^{89}Sr. A. Bisi, S. Terrani, and L. Zappa (Polytechnic Inst. of Experimental Physics, Milan). Nuovo cimento (10) 2, 1297-1300(1955) Dec. (In English)

The β-ray spectrum of Sr^{89} was investigated in an intermediate image β-ray spectrometer. The transition energy was found to be: E_0 = 1.462 ± 0.005 Mev. The spectral shape from the end-point down to about 140 kev agrees with what is to be expected from a unique first forbidden transition (ΔI = 2, yes). No branching at the 0.913 Mev isomeric level of Y^{89} ($\gamma/\beta < 5 \times 10^{-6}$), nor other γ rays were observed. (auth)

4997

UPPER LIMIT OF AN α BRANCHING IN UX_1 (Th^{234}). S. Deutsch (Univ. of Brussels) and M. Nikolic. Nuovo cimento (10) 2, 1326-7(1955) Dec. (In French)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4998

ALIGNMENT OF THREE ODD-A RARE-EARTH NUCLEI. E. Ambler and R. P. Hudson (National Bureau of Standards, Washington, D. C.) and G. M. Temmer (Carnegie Institution of Washington, D. C.). Phys. Rev. 101, 196-200(1956) Jan. 1.

The results of nuclear magnetic hfs alignments on Ce^{139} are presented and are discussed in relation to those previously obtained for Ce^{141} and Nd^{147}. It is shown that the γ-ray anisotropies, ε, in the case of Ce^{139} are consistent with a decay sequence $3/2^+ \rightarrow 5/2^+ \rightarrow 7/2^+$, the γ transition being M1 with ~4% admixture of E2. Even such a small admixture of E2 has an important effect upon the anisotropy through the interference term. Other factors which might affect the anisotropy are discussed: electron spin-spin interactions are important, whereas reorientation effects due to long lifetimes in the intermediate state are not. Interference is also important in the case of the 92-kev γ ray following the decay of Nd^{147}, where ~3% admixture of E2 radiation is needed to explain our results. It seems likely also that there is a similar effect in the 142-kev γ ray following the decay of Ce^{141}. The similarity of these mixtures (same magnitude and phase φ = 0) may not be fortuitous, since in each case the γ ray connects levels which are classified by the shell model as $d_{5/2}$ and $g_{7/2}$. In the cases of Ce^{141} and Nd^{147} the $g_{7/2}$ state lies uppermost and ε is reduced by the E2 admixture, whereas ε is increased in Ce^{139}, where the levels are inverted. (auth)

SHIELDING

4999 CF-53-6-1(Rev.)

[Oak Ridge National Lab., Tenn.]

DECAY GAMMA-RAY DOSE RATE MEASUREMENTS AT THE BSF. T. V. Blosser and M. K. Hullings. Apr. 12, 1955. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Radiation at various distances (0 to 9 ft.) above the BSF for 0 to 4 hrs after shutdown were measured and are shown graphically. Analysis of the data will enable a determination of the necessary water shield for a given radiation level at various times after shutdown. (F.S.)

5000 NNSD-NSPS-1008

Newport News Shipbuilding and Dry Dock Co., Va.

INFLUENCE OF SHIELD CONFIGURATION ON CARGO CAPACITY OF NUCLEAR POWERED SHIPS. O. H. Klepper. Jan. 16, 1956. 48p. $0.35(OTS).

A comparison is made of cargo carrying capacity and approximate gross revenue of a nuclear powered cargo ships and a nuclear powered tanker using lead, oil, and structure for secondary shielding. (auth)

5001 WAPD-RM-217

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

APPLICATION OF GAMMA RAY BUILD-UP DATA TO SHIELD DESIGN. J. J. Taylor. Jan. 25, 1954. Decl. June 28, 1954. 17p. Contract AT-11-1-GEN-14. $0.20 (OTS).

A method is demonstrated for calculating γ-ray penetration in infinite homogeneous media by the NBS-NDA procedure, using microscopic cross sections and scattering functions. Required integrations are solved by a reduction to the problem where the attenuation kernel is a

simple exponential. Dose and energy build-up factors are calculated in H_2O, Fe, and Pb for point isotropic energy sources in the range 0.5 to 10 Mev. (K.S.)

SPECTROSCOPY

5002 AD-52850

California Inst. of Tech., Pasadena. Norman Bridge Lab. of Physics.

[RESEARCH IN X-RAY PHYSICS]. Final Report [for] Period March 1, 194?–November 30, 1954. Jesse W. M. DuMond. 42p. Contract N6onr-244, Task Order IV.

Research was concerned with the development of 2-meter curved-crystal spectrometer, axial focusing the magnetic β-ray spectrometer companion instrument to the 2-meter curved-crystal spectrometer, the development of new techniques for low-angle X-ray-diffraction, and the sine-measuring interferometer for the proposed new curved-crystal γ-ray spectrometer. Thirty-two abstracts are included for special technical reports. (ASTIA abst.)

5003 NP-5865

Johns Hopkins Univ., Baltimore.

THE SPECTRUM OF XENON I. Spectroscopic Report No. 12. M. Thekaekara, G. H. Dieke, and H. M. Crosswhite. Dec. 1955. 103p. Project No. TB2-0001 (488). Contract No. DA-36-034-ORD-1311.

Data are presented on the xenon I spectrum. Energy levels, intensities, hyperfine structure, line broadening, and wave length shifts are tabulated. (C.W.H.)

5004 AERE-Lib/Trans-444

STARK EFFECT BROADENING OF THE BALMER LINES AT HIGH ELECTRON DENSITIES. H. Griem. Translated by R. J. Richardson from Z. Physik 137, 280-94(1954). 13p.

The profiles of the Balmer lines emitted by a water-stabilized arc with high electron density were measured for different current strengths. To interpret these, the influence of the ionic and electronic fields was investigated theoretically. Results indicate theoretical profiles may be plotted which are in good agreement with the measured line profiles. Electron densities result from the calculation which are lower but of the same order of magnitude as those calculated according to the Holtsmark theory. The asymmetry of the H_β line and the displacement of H_γ were measured and accounted for theoretically. (auth)

5005

STUDIES WITH THE SCINTILLATION SPECTROMETER. R. K. Gupta and S. Jha (Tata Inst. of Fundamental Research, Bombay, India). Nuclear Phys. 1, No. 1, 2-8(1956).

The setting-up of a single crystal NaI(Tl) spectrometer is described. The efficiency of the well-type crystal for γ rays has been determined by the summing technique. In the γ-ray spectrum of I^{128}, in addition to the well known 440-kev γ ray, a γ ray of energy 960 ± 6 kev and two feeble γ rays of energy 520 and 750 kev have been found. (auth)

5006

ENERGY LEVELS AND WAVELENGTHS OF NATURAL CADMIUM AND OF CADMIUM-115. Kelvin Burns (Allegheny Observatory, Pittsburgh) and Kenneth B. Adams (Westinghouse Research Labs., East Pittsburgh). J. Opt. Soc. Amer. 46, 94-9(1956) Feb.

In the region 8200 to 2144 A the wave lengths or vacuum wave numbers of 73 lines in the first spectrum and 11 in the second spectrum of Cd have been measured relative to Ne and Hg^{198} standards. A description of the sources and experimental conditions is given. (D.E.B.)

Refer also to abstract 4797.

THEORETICAL PHYSICS

5007 CF-52-7-165

Oak Ridge National Lab., Tenn.

TEMPERATURE DISTRIBUTION IN A SLAB CONTAINING A UNIFORMLY DISTRIBUTED SOURCE OF RADIATION. N. F. Lansing and L. C. Noderer. July 25, 1952. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The mathematical analysis of the equilibrium distribution, assuming only conduction, in an infinite slab containing a uniformly distributed source of radiation is given. (F.S.)

5008 NYO-7593

Rochester, N. Y. Univ.

LECTURES ON DISPERSION THEORY. Abdus Salam. (Notes by G. Sudarshan and P. Signell). Apr. 1956. 25p. Contract AT(30-1)-875. $4.80(ph OTS); $2.70(mf OTS).

Lectures with mathematical analysis are given on Dispersion Theory and Causality and Dispersion Relations for Pion-nucleon Scattering. The appendix includes the S-matrix in terms of Heisenberg Operators. (F.S.)

5009

THE SELF-STRESS PROBLEM AND THE LIMITS OF VALIDITY OF QUANTIZED FIELD THEORIES. E. Arnous (National Center of Scientific Research, Paris) and W. Heitler (Univ. of Zurich, Germany). Nuovo cimento (10) 2, 1282-96(1955) Dec. (In English)

The conditions for the vanishing of the self-stress of a particle are investigated in a general manner. The following types of fields and interactions are considered: electromagnetic field, electrons, scalar or pseudoscalar mesons, nucleons, with the usual interactions including both types of meson-nucleon interaction, and the five types of β-decay interaction. It is shown that the self-stress of any of these particles vanishes if its exact self energy at rest is a homogeneous function of the theoretical masses of all existing particles. The condition can easily be fulfilled if a suitable invariant cut-off is introduced. From the mass difference of charged and neutral π mesons, the cut-off momentum can be determined, and it turns out to be of the order of the nucleon mass. It is conjectured that this has universal significance. It is shown that the changes introduced by such a cut-off in quantum electrodynamics are beyond the reach of present experiments. The implications on meson theory are discussed. (auth)

5010

A REALISTIC THEORY OF MESONS. B. Jouvet (Institut Henri Poincaré, Paris). Nuovo cimento (10) 2, Suppl. No. 4, 941-68(1955).

A realistic concept of mesons limited to pseudoscalar interactions is presented. The existence of mesons whose masses and coupling constants are expressed with the properties of fermions only are demonstrated, allowing a unification of the Fermi and Yukawa theories. Rules for the treatment of S matrix terms are given, and elementary particle problems discussed. (D.E.B.)

5011

ON THE SATURATION OF NUCLEAR MAGNETIC RESONANCE. Francois Lurcat. Compt. rend. 241, 1932-4(1955) Dec. 19. (In French)

In the case where there are many "spin-medium" relaxation times, the saturation factor is not given by the classical formula $S = (1 + 2\lambda T_1)^{-1}$. This formula remains approximately valid if T_1 is replaced by a saturation time Θ which is calculated. (tr-auth)

5012

APPLICATION OF THE VARIATIONAL METHOD TO THE CALCULATION OF PROTON-PROTON SCATTERING IN

THE REGION 0-5 MEV. S. Skavlem and I. Espe. Arkiv Fysik 10, No. 1, 89-96(1956).

A calculation of the proton-proton scattering on the basis of a Yukawa potential, corresponding to meson masses 300 m_e, 370 m_e and 400 m_e, respectively is given. The best fit with recent scattering experiments is obtained with a meson mass of 334 m_e. A simple explicit expression for the proton-proton S-wave function is worked out. The nuclear scattering phase shift and the S-wave function are both expanded in powers of k^2, the square of the relative wave number, and only two terms in these expansions are taken into account. (auth)

5013

ON THE ELECTROMAGNETIC PROPERTIES OF THE DEUTERON. M. Sugawara. Arkiv Fysik 10, No. 2, 113-28 (1956). (cf. NSA 9-7592)

The exchange current corrections to the quadrupole and magnetic moments of the deuteron have been calculated, assuming the sym. ps-ps meson theory and employing T-D formalism, neglecting the nucleon recoil energy in the energy denominator and retaining only the one meson amplitude. Also, the non-additivity and the relativistic corrections have been estimated in the same approximation. It is shown that the exchange correction of the magnetic moment is rather unambiguous and is estimated as -0.85% of its empirical value, while that of the quadrupole moment is somewhat ambiguous and may be estimated as from +2% to zero or even a small negative value of its empirical value. The non-additivity and the relativistic corrections are estimated as +0.26% and -0.41%, respectively. The latter two effects are uncertain but almost cancel each other; thus the final estimate of the magnetic moment correction is rather definite and is $-1.0 \pm 0.3\%$. This correction, in turn, determines the D-state probability as $2.4 \pm 0.5\%$. Including the over all errors, the final estimate of the D-state probability is $3 \pm 1\%$, a definitely smaller value than 4%. (auth)

5014

A THEORETICAL STUDY OF THE TIME ENERGY DISTRIBUTION OF SLOWED-DOWN NEUTRONS. Olof Olsson. Arkiv Fysik 10, No. 2, 129-44(1956).

The time energy distribution of neutrons slowed down by elastic impacts against free atoms at rest is considered. Capture is neglected. The scattering of the neutrons is assumed to be isotropic in the center-of-mass system. The validity of the considerations is thus confined to neutron energies lying approximately in the range between 1 ev and 10 Mev. (auth)

5015

THE DISTRIBUTION OF CHARGE IN THE NUCLEUS. Kenneth W. Ford (Indiana Univ., Bloomington) and David L. Hill (Los Alamos Scientific Lab., N. Mex.). Ann. Rev. Nuclear Sci. 5, 25-72(1955).

Scattering of relativistic electrons by nuclei, effects of the nucleus on bound electrons, the interaction of μ-mesons and nuclei, and nuclear Coulomb energy are discussed from the standpoint of their contribution to nuclear charge distribution studies. (D.E.B.)

5016

THE THEORY OF PHOTONS AND ELECTRONS. THE RELATIVISTIC QUANTUM FIELD THEORY OF CHARGED PARTICLES WITH SPIN ONE-HALF. J. M. Jauch and F. Rohrlich. Cambridge, Addison-Wesley Publishing Co., Inc., 1955. 488p.

For the first time in the history of this field of research it has become possible to give a unified and consistent presentation of radiation theory in full conformity with the principles of relativity and quantum mechanics. (auth)

5017

SINGLE-BODY WAVE FUNCTIONS AND TWO-BODY FORCES. Yü-Chang Hsieh and Ingram Bloch (Vanderbilt Univ., Nashville, Tenn.). Phys. Rev. 101, 205-9(1956) Jan. 1.

It is found that some of the eigenfunctions of a nuclear Hamiltonian containing Hooke's-law interactions of nucleons can be expressed as independent-particle states. In these states it is more satisfactory to define the nucleons' positions with respect to the centers of mass of the protons and of the nucleons, rather than with respect to a fixed origin. There is some reason to believe that all nuclear bound states can be approximated by means of perturbations from such independent-particle states. (auth)

5018

KINETIC ENERGY IN NONLINEAR MESON THEORY. D. H. Holland (Univ. of California, Berkeley). Phys. Rev. 101, 451-2(1956) Jan. 1.

An alternative definition of the gradient terms in the lattice space quantization method is used to calculate the energy of a nonlinear meson. The expansion in powers of momentum agrees somewhat better with the relativistic expansion than the result previously reported by Schiff. (auth)

5019

LOW'S SCATTERING EQUATION FOR THE CHARGED AND NEUTRAL SCALAR THEORIES. L. Castillejo and R. H. Dalitz (Cornell Univ., Ithaca, N. Y.) and F. J. Dyson (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 101, 453-8(1956) Jan. 1.

The Low scattering equation is studied in the one-meson approximation with both charged and neutral scalar meson theories. The general solution is found for each of these cases. It has the general character of a Wigner-Eisenbud dispersion formula and contains an infinite number of adjustable parameters. It follows that the Low equation, in this approximation at least, does not determine the scattering, but only expresses a property of the scattering which is independent of the internal structure of the scatterer. (auth)

5020

STRUCTURE OF GREEN'S FUNCTIONS IN QUANTUM FIELD THEORY. II. Yoichiro Nambu (Institute for Nuclear Studies, Chicago). Phys. Rev. 101, 459-67(1956) Jan. 1.

In continuation of previous work, it is shown that Green's functions of general order, which involve an arbitrary number of field operators, can be represented as parametric integrals with invariant energy denominators and real spectral functions. The analysis is carried out in detail in the case of neutral scalar fields, but a brief discussion is also made of spinor fields. The (renormalized) equations of motion which give a connection between the Green's functions of different order are converted into the corresponding equations for the spectral functions, which proves that our formulas are consistent and manifestly renormalized, with no infinities inherent in them. (auth)

5021

PION-NUCLEON s-WAVE PHASE SHIFTS FROM ps-ps WITH CUTOFF. Charles J. Goebel (Univ. of Chicago). Phys. Rev. 100, 468-82(1956) Jan. 1.

An investigation of the pion-nucleon s-wave scattering in the ps-ps theory is made, using a cutoff $\leq$ the nucleon mass, and the ("exact") Foldy nonrelativistic transformation of the Hamiltonian. The phase shifts are calculated approximately in the three-meson Tamm-Dancoff approximation, however, without inclusion of the meson-meson interaction. No appreciable isotopic-spin dependence is found. (auth)

5022
INTERACTION OF ANTIPROTONS WITH NUCLEAR FIELDS. Hans-Peter Duerr and Edward Teller (Univ. of California, Berkeley). Phys. Rev. 101, 494-5(1956) Jan. 1.

A relativistic generalization of the velocity-dependent nuclear interactions, which leads to a very strong attraction between antiprotons and nuclei, is discussed. The manner in which the attraction is obtained is given. Energy levels for nucleons and antinucleons are diagrammed. (B.J.H.)

TRITIUM AND TRITIUM COMPOUNDS

5023
DETERMINATION OF TRITIUM IN TRITIATED WATER. A. Finkelstein and M. Lesimple (Commissariat a l'Energie Atomique, Fort de Chatillon, France). J. Nuclear Energy 2, 101-9(1955) Dec. (In French)

A simple determination of tritium in tritiated water has been developed, using the reaction of tritiated water on calcium carbide, and counting the acetylene formed in a calibrated ionization chamber. No memory effects have been observed; a slight isotopic separation was detected and estimated. (auth)

URANIUM AND URANIUM COMPOUNDS

5024 AECU-3251
RAND Corp., Santa Monica, Calif.
RELATIVISTIC AND NON-RELATIVISTIC ENERGY LEVELS IN URANIUM. Richard Latter. Mar. 29, 1955. 9p. Contract AT(29-1)-1477. (RM-1453-AEC). $1.80 (ph OTS); $1.80(mf OTS).

Results of the Schrödinger and Dirac equations for energy levels of uranium are compared with the eigenvalues and experimental values. For large atomic numbers both equation values show departures from experimental values. (F.S.)

5025 ANL-5534
Argonne National Lab., Lemont, Ill.
WORK FUNCTION, IONIZATION POTENTIAL, AND EMISSIVITY OF URANIUM. E. G. Rauh. May 1956. 21p. Contract W-31-109-eng-38. $0.30(OTS).

Techniques for maintaining pressures of 10^{-9} to 10^{-10} mm Hg have been established for high-temperature measurements and properties of U affected by gas pressures. The value of the work function approaches a limiting value of 3.47 ± 0.02 ev and the ionization potential was shown to be greater than 4.53 ev. The reflectivity was found to be 0.735 ± 0.015 and the emissivity was calculated to be 0.265 ± 0.015. The resistivity was calculated from the reflectivity and the Drude relationship to be 22 μohm-cm. (F.S.)

5026 AERE-Lib/Trans.-549
THE LUMINESCENCE OF URANYL GLASSES AND CRYSTALS. A. N. Sevchenko. Translated by V. Beak from Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 13, 188-202(1949). 20p.

An investigation was made of the polarization of luminescence in uranyl glasses. Data are presented on the dependence of the polarization of luminescence in uranyl glasses upon their chemical composition; the extinction curves and luminescence spectra of uranyl glasses and crystals; and the effects of uranyl concentration on the degree of polarization of luminescence in uranyl glasses. (C.H.)

5027
RANGE AND RANGE DISPERSION OF SPECIFIC FISSION FRAGMENTS. W. M. Good and E. O. Wollan (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 249-53(1956) Jan. 1.

The range and dispersion in range of specific U^{233} and U^{235} fission fragments; namely, those associated with delayed-neutron emitters have been determined in gases of different atomic number. These measurements give the Z-dependence of the range and range dispersion for fragments associated with a specific mode of fission. After corrections for foil thickness and geometry the Z-dependent part of the range dispersion which arises from the nuclear stopping process was determined and values were obtained for the residual component corresponding to the energy dispersion associated with the fission process itself. The values thus obtained for this energy dispersion are found to be in fair accord with recent theoretical results of Fong. (auth)

5028
DEPOSIT OF UO_2 ON Al BY ELECTROLYSIS. Lydie Koch (Centre d'Etudes nucléaires, Saclay, France). J. Nuclear Energy 2, 110-11(1955) Dec. (In French)

A method is described for the preparation of UO_2 layers strongly adherent to large areas of aluminum sheet. The thickness of the deposits may reach 3 mg/cm^2. (auth)

5029
FISSION CROSS-SECTIONS AS A FUNCTION OF NEUTRON ENERGY. I. URANIUM-235. B. T. Price (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 2, 128-40(1955) Dec.

The variation of the fission cross section of U^{235} has been compared with that of the boron (n,α) cross-section, for neutron energies (E_n) within the range $0.005 \text{ ev} < E_n < 150 \text{ ev}_n$ The measurements for $E_n < 1$ ev give the relative values σ_{fiss} to an accuracy of better than 2 per cent. Values are given for the effective fission cross-section of a thin sample in a (dE/E) neutron spectrum, averaged over four energy intervals within the range 0.8 ev to 100 ev. (auth)

5030
THE DECAY SCHEME OF URANIUM 235. Sven A. E. Johansson. Arkiv Fysik 10, No. 2, 97-108(1956).

The γ radiation from enriched U^{235} has been investigated by means of a coincidence scintillation spectrometer. Gamma rays were found at 74, 110, 184, 200, 289, and 382 kev. The coincidence relations between the γ rays were investigated in detail. These measurements lead to a decay scheme which is in good agreement with the α spectrum. The possibility to interpret the level scheme as a system of rotational bands is discussed. (auth)

PATENTS

CHEMISTRY

5031
FILTERING APPARATUS. R. W. Dodson et al (to U. S. Atomic Energy Commission). U. S. Patent 2,732,072, January 24, 1956.

A remote-controlled filtering apparatus to handle radioactive slurries and to isolate the filtrate in a shipping container by air pressure or vacuum is described. The apparatus consists of concentric containers, an inner container holding a slurry and an outer container for the filtrate, tubes to charge and discharge the containers, and a filtrate shipping container. The entire apparatus is protected by lead shielding and is a safe convenient method of filtering such fluids. (auth)

5032
PRODUCTION OF UCl_4. Myron B. Reynolds et al (to U. S.

Atomic Energy Commission). U. S. Patent 2,733,123, January 31, 1956.

A method is outlined for preparing an active form of UO_2 which is characterized by being readily oxidized in air at room temperature or easily converted to UCl_4 by chlorination with CCl_4 or $SOCl_2$ at elevated temperatures. The highly active UO_2 is obtained by reducing UO_3 with a mixture of ethyl alcohol and an inert gaseous diluent such as nitrogen at a temperature in the range of 200 to 425°C. (auth)

5033

MANUFACTURE OF URANIUM TETRACHLORIDE. S. Rosenfeld (to U. S. Atomic Energy Commission). U. S. Patent 2,733,124, January 31, 1956.

Uranium oxides such as UO_2 and UO_3 can be converted to UCl_4, by contacting a mixture of CCl_4 and $CHCl_3$ substantially in the ratio of 3:1 with UO_2, UO_3, or a mixture of the same while maintaining a temperature in the range of 400 to 500°C. (auth)

5034

RECOVERY OF URANIUM FROM WASTE METAL PRODUCTS. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent 2,733,125, January 31, 1956.

Uranium (as aqueous UO_2SO_4) can be recovered from U by burning the dross in air to obtain U oxides, mixing the oxides with lime, roasting this mixture in air at a temperature between 600 and 1000°C, treating this product with aqueous 5% to 50% H_2SO_4 solution in such amount as to provide one SO_4^{2-} for each atom of Ca and U in the mixture, adding an oxidizing agent to convert any U of lower oxidation state to the 6+ oxidation state, and mechanically separating solid matter from the resulting solution. (auth)

5035

URANIUM LIBERATION. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent 2,733,126, January 31, 1956.

A process is discussed for recovery of U from the U bearing alkaline earth metal fluoride slag obtained as a result of reducing UF_4 by an alkaline earth such as Ca or Mg to produce massive U metal. The slag is crushed, roasted at a temperature between 600 and 1000°C, ground, and then treated with concentrated H_2SO_4 at a temperature of between 200 and 300° to drive off substantially all fluoride as HF. The sulfated product is digested in H_2O in the presence of an oxidizing agent to ensure all U is in the 6+ oxidation state. This solution is neutralized to a pH of between 2 and 5. Any remaining solids are mechanically removed, resulting in an aqueous UO_2SO_4 solution. (auth)

5036

PRECIPITATION OF FLUORIDE-FREE URANIUM TETRAOXIDE. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent 2,733,127, January 31, 1956.

Uranium (as a peroxide of low fluorine content) can be separated from an aqueous UO_2SO_4 solution containing both Mg^{2+} and F^-, by adding to the solution between about 0.4 and 1 mole of H_3BO_3 for each mole of UO_2SO_4, then adding sufficient H_2O_2 to convert the U to UO_4 while maintaining the solution pH between about 2 and 4 and the temperature between 30 and 65°C, and separating the UO_4 from the resulting mother liquor. (auth)

5037

PROCESS FOR THE RECOVERY OF U IN THE PRESENCE OF IRON. A. E. Ballard (to U. S. Atomic Energy Commission). U. S. Patent 2,733,128, January 31, 1956.

A method for the quantitative recovery of U from a dilute nitrate solution containing Fe impurity is described. After concentrating to a U content of about 5%, the bulk of the Fe is removed as an easily filtered precipitate in the presence of SO_4^{2-} under controlled pH conditions of about 3.0 to 3.8. The Fe precipitate is dissolved and the solution obtained is electrolyzed to plate out various metallic contaminants away from the U, the U containing solution from this step may be combined with the filtrate from the Fe removal step and treated to recover the U. (auth)

5038

PURIFICATION OF NICKEL POWDER. John W. Glenn (to U. S. Atomic Energy Commission). U. S. Patent 2,733,142, January 31, 1956.

Iron traces can be removed from mechanically ground Ni powder by washing the Ni powder with a 1% to 20% aqueous solution of an organic acid such as formic, acetic, lactic, and the like at a temperature in the rate from 20 to 100° and then removing the wash solution from the purified Ni powder. (auth)

5039

ELECTROLYTIC CELLS. R. Q. Boyer (to U. S. Atomic Energy Commission). U. S. Patent 2,733,202, January 31, 1956.

An improved electrolytic reduction cell has been developed comprising a casing provided with a catholyte passage of maximum length within the casing, and contacting electrode structure arranged to afford a large uniform reducing action upon the metallic ions contained in the catholyte. The arrangement provides for a pool of liquid metal in the lower portion of the cell, with the electrolyte in the upper portion floating thereon. The cathode structure mounted on a removable frame is rotatable and is utilized to propel the electrolyte through the elongated passage forward in the casing. A gastight cover supporting the electrode structure depending therefrom is constructed in part of transparent material to facilitate observation of the interior of the cell, and a syphon mechanism is provided for charging and discharging electrolyte. (auth)

5040

PROTECTIVE COATING COMPOSITION COMPRISING A POLYMER OF CHLOROPRENE AND AN ALKALINE EARTH METAL FLUORIDE. Allan J. Carter, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,734,042, February 7, 1956.

This protective coating composition is particularly useful in coating, impregnating or close association with fibrous materials to produce a fabric which provides protection to workers with chemically corrosive substances such as F_2, Cl_2, HF, and the like. The coating consists essentially of a synthetic rubber base, Neoprene G N, which is compounded with an alkaline earth fluoride. (auth)

5041

PROCESS FOR PREPARATION OF CHLORIDES OF URANIUM. Ernest C. Evers, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,734,795, February 14, 1956.

Uranium chlorides can be prepared by reacting an U oxide such as UO_3, with liquid CCl_4 in the presence of initially added extraneous UCl_5 at an elevated temperature in the range from 80 to 200°C. The reaction mixture is agitated during the reaction period to prevent caking. Uranium pentachloride is the principal product, which may readily be converted to CCl_4 by bleeding off the evolved by-product gases during the reaction period. (auth)

5042

OXIDATION OF URANOSIC OXIDE TO URANIUM TRIOXIDE WITH NITRIC ACID VAPOR. Edward R. Flook, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,735,745, February 21, 1956.

Uranosic oxide (U_3O_8) is oxidized to UO_3 by heating uranosic oxide at a temperature between 400 to 500°C in the presence of HNO_3 vapor for a suitable period of time and then cooling the reactants to below 400°C while maintaining

HNO_3 vapor in the system until the reactants are cooled below 400°C. (auth)

5043

METHOD OF PRODUCING URANIUM TETRACHLORIDE. H. R. McCombie and E. L. Wagner (to U. S. Atomic Energy Commission). U. S. Patent 2,735,746, February 21, 1956.

Uranium tetrachloride has been prepared by introducing finely divided UO_2 into an elongated reaction zone having a temperature gradient between the input and discharge points from 440 to 475°C continually advancing the UO_2 through the reaction zone, introducing a counter current of gaseous CCl_4 within the advancing mass of UO_2 so as to produce finely divided crystalline UCl_4 and means of continuously withdrawing the UCl_4 from the chamber. Carbon tetrachloride may be recovered from the gaseous reaction products and recycled. (auth)

5044

URANIUM ALKOXY COMPOUNDS AND METHOD OF PREPARING SAME. Henry Gilman and Ernest Bindschadler (to U. S. Atomic Energy Commission). U. S. Patent 2,735,857, February 21, 1956.

Under substantially anhydrous conditions a uranium tetrahalide is reacted with an alkali metal alkoxide having not more than four carbon atoms, then subjecting the reaction mixture containing the tetraalkoxide to oxidation with O_2 under substantially anhydrous conditions whereby a uranium pentaalkoxide is formed, and recovered by fractional vacuum distillation. By treating uranium pentaalkoxide under substantially anhydrous conditions with an alkali metal alkoxide in alcohol having the same number of carbon atoms as the alkoxide of the uranium pentaalkoxide there is formed an alkali metal uranium hexaalkoxide addition compound which is oxidized by means of a carboxylic peroxide and the uranium hexaalkoxide is recovered by fractional vacuum distillation. (auth)

5045

PROCESS FOR EXTRACTING URANIUM FROM ITS ORES. A. M. Gaudin et al (to U. S. Atomic Energy Commission). U. S. Patent 2,736,634, February 28, 1956.

A process is presented for extracting uranium values from uranium bearing ores which may be subjected to a preliminary moderate heat treatment to render the uranium more readily soluble in an acid leaching solution, then treating said ore at ambient temperatures with an unheated leaching solution containing sulfuric acid and initially added ferric sulfate, and recovering the uranium values from the solution. (auth)

5046

RECOVERY OF URANIUM FROM GOLD ORE LEACH RESIDUES. A. M. Gaudin (to U. S. Atomic Energy Commission). U. S. Patent 2,737,438, March 6, 1956.

Uranium has been recovered from U and Au-bearing ores, by extracting the Au from the finely ground ore by means of an aqueous solution of an alkali metal cyanide, treating the residue from the Au extraction step with an aqueous H_2SO_4 solution containing ferrous and ferric ions to leach U values from the residue and recovering U values from the resulting leach solution. If the ore contains Fe in addition to Au and U, the addition of MnO_2 in the aqueous H_2SO_4 leach is desirable to aid in dissolving the Fe and converting the same to the ferric condition thereby improving the leaching of the U values. (auth)

5047

CYCLIC PROCESSES OF PRODUCING UCl_5. J. M. Carter (to U. S. Atomic Energy Commission). U. S. Patent 2,737,439, March 6, 1956.

Uranium hexachloride has been produced from UCl_5 by converting the UCl_5 into UCl_6 and UCl_4, removing the UCl_6, converting the remaining UCl_4 into a uranium oxychloride by reaction with a dry air stream, converting the uranium oxychloride into UCl_5, and then repeating the cycle employing the UCl_5 thus obtained. (auth)

ENGINEERING

5048

DIAPHRAGM PUMP. E. T. Booth (to U. S. Atomic Energy Commission). U. S. Patent 2,732,127, January 24, 1956.

An all-metal pump has been designed to handle radioactive corrosive gases. A novel feature is the use of a metallic diaphragm actuated by air pressure alternating with vacuum. Reed-type valves prevent reverse flow eliminating the need for ordinary lubricants. This results in a compact corrosion-resistant rugged leak-tight pump designed for high-speed use over a long period of time. (auth)

5049

DIAPHRAGM PUMP. V. L. Parsegian (to U. S. Atomic Energy Commission). U. S. Patent 2,732,807, January 31, 1956.

Information is presented on a pump designed to handle highly radioactive liquids. The pump is operated by compressed air pressure and contains two independent pumping sections. One way valves prevent reverse operation and controllable air pressures move the diaphragm so as to force the liquid through the valves and diaphragm chambers in metered amounts that remain constant over a long period of use. (auth)

5050

MAGNETIC CONTROL DEVICE FOR PUMPS. T. H. Edwards (to U. S. Atomic Energy Commission). U. S. Patent 2,734,678, February 14, 1956.

A magnetic control device is used for controlling a mercury pump of the positive displacement type. The control device is responsive to the level of the mercury within the discharge check valve and energizes a circuit thereby ending the discharge cycle and initiating the intake phase of the pump cycle. This is accomplished by a rotatable magnet which is placed adjacent the discharge valve and is caused to rotate when a magnetic float within the valve raises so as to place a magnet within the float adjacent the aforesaid rotatable magnet. When this occurs the rotatable magnet is pivoted to a new position where it attracts a third magnet which is attached to a movable contact which in turn controls the phase of the pump cycle. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

5051

TERNARY URANIUM ALLOY. F. A. Rough and H. A. Saller (to U. S. Atomic Energy Commission). U. S. Patent 2,735,761, February 21, 1956.

The preparation of 5 wt. % Cr–(0.5 to 10) wt. % Fe–U alloys is described. This combination of elements produces an alloy suitable for fueling a neutronic reactor having the advantageous features of low viscosity when fused, low melting point, good thermal conductivity, and low neutron capture cross-section. These features are uniquely useful in that the cast fuel completely fills core interstices and produces a good bond with the metal piping as well as satisfying the nuclear requirements of a fuel. (auth)

5052

REACTOR CONTROL. A. M. Weinberg, G. J. Young, P. Morrison, and L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,735,811, February 21, 1956.

A fast-acting control system for a neutronic reactor is composed of an ionization chamber in the reactor to detect an increased neutron density, a control rod, a container exterior to the core filled with an aqueous solution of a volatile ammonium compound and a tube entering the core area into which both the control rod and the ammonium solution may be forced and means for accomplishing such an insertion. Since the time for arresting an excursion may be extremely limited, the fact that the ammonium solution can be introduced under pressure into the core faster than a gravity insertion of the control rod is of considerable importance. The ammonium solution being completely volatile will leave no deposits in the tube which may poison the reactor. (auth)

5053

ZIRCONIUM TERNARY ALLOYS. Arthur D. Schwope et al (to U. S. Atomic Energy Commission). U. S. Patent 2,736,651, February 28, 1956.

Ternary Zr-base alloys containing 1 to 6 wt. % Sn and 0.1 to 4.0 wt. % Al were prepared. These alloys are creep resistant and characterized by tensile strength equal approximately to that of stainless steel at elevated temperatures. (auth)

PHYSICS

5054

ULTRA HIGH SPEED LIGHT SHUTTER. B. Brixner (to U. S. Atomic Energy Commission). U. S. Patent 2,732,777, January 31, 1956.

A high speed explosively operated shutter for a camera that permits of an exposure as short as 3 μsec duration has been developed. A clear glass block is inserted in the light path between two lucite windows and a detonator is held tightly against the glass block by a cap through which wires run to fire the detonator. In operation a timed electrical impulse sets off the detonator which shatters the glass rendering it opaque to light passage without damage to the shutter housing. (auth)

5055

REGULATOR FOR CALUTRON ION SOURCE. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,733,342, January 31, 1956.

This regulator is composed of an electron emissive cathode, a bombardment cathode, a control electrode therebetween, means for maintaining the bombardment cathode at a positive potential with respect to the electron emissive cathode whereby the bombardment cathode is heated to emissive temperature by electron bombardment, an anode, means for maintaining the anode at a positive potential with respect to the bombardment cathode whereby an electric discharge is maintained therebetween. A variable impedance device, having an inductive control member connected in series with the electric discharge, is connected to the control electrode whereby the potential of the control electrode is controlled in accordance with and respective to the discharge current. (auth)

5056

IONIZATION SOURCE. M. G. Inghram et al (to U. S. Atomic Energy Commission). U. S. Patent 2,733,343, January 31, 1956.

A positive ion source has been developed for use in mass spectrometers. It provides a surface ionization source in which the evaporation rate of the material to be analyzed is independent of the temperature at which the material is evaporated, thereby alleviating the difficulties encountered with such sources. Thus an ion source is provided which will produce ionized atoms of elements which heretofore have been ionized by surface ionization only in the form of molecules. It is comprised of an ionization filament, an evaporation filament adapted to be coated with the material to be ionized, and means to mount the filaments in adjacent relationship. The filaments being spaced by an average distance equal to not more than twice the width of the ionization filament confronting the evaporation filament. (auth)

5057

ION GENERATOR REGULATOR. R. de Liban (to U. S. Atomic Energy Commission). U. S. Patent 2,733,344, January 31, 1956.

The cathode of the calutron ion source is heated by an alternating current supply which is also rectified to supply the arc potential between the cathode and anode. The important feature is a phasing circuit for controlling the current through the ion source cathode inversely in accordance with the current drawn by the arc to maintain the arc current constant. (auth)

5058

REGULATOR FOR CALUTRON ION SOURCE. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,733,345, January 31, 1956.

This regulator is comprised of an ion generator having an electron emissive cathode, a bombardment cathode and an anode, a source of bombardment current supply connected between the electron emissive cathode and the bombardment cathode, a triode connected in series with the bombardment current supply, a source of arc current supply connected between the bombardment cathode and the anode, a second triode, a resistor connected in series with the arc current supply and across the input of the second triode. An important feature is the connection of means between the triodes for controlling the impedance of the first triode in accordance with the arc current of the ion generator. (auth)

5059

ION PRODUCING MECHANISM. F. Oppenheimer (to U. S. Atomic Commission). U. S. Patent 2,733,346, January 31, 1956.

A modified ion generator for a calutron is comprised of a gas source, an ionizing chamber open at both ends, a slot running along one wall from end to end, an electron emissive filament at one end of the chamber, an anode at the other end and a means for maintaining an arc between the anode and the filament. This results in an arc which is improved in uniformity both in time and throughout its length. (auth)

5060

REACTOR FOR CALUTRON ION SOURCE. R. de Liban (to U. S. Atomic Energy Commission). U. S. Patent 2,733,347, January 31, 1956.

This reactor is comprised of an ion source having an anode and a cathode, a resistor connected in series with a pair of feeders for supplying heating current to the cathode through the resistor, a variable impedance apparatus connected across the resistor including gas discharge device means, and means for controlling the gas discharge device means in accordance with the arc current between the anode and the cathode whereby the current to the cathode is controlled to maintain the arc current substantially constant. (auth)

5061

ION SOURCE UNITS. E. J. Lawton et al (to U. S. Atomic Energy Commission). U. S. Patent 2,733,348, January 31, 1956.

The electrode arrangement in the arc block of a calutron ion source has been modified. It removes the prior difficulty encountered wherein the electron trimming aperture permitted quantities of vapor to escape and thus reduce the efficiency of the ion source. This is accomplished by making

the cathode a structural part of the arc chamber closure. (auth)

5062

CALUTRON. E. O. Lawrence et al (to U. S. Atomic Energy Commission). U. S. Patent 2,733,349, January 31, 1956.

An electromagnetic device is utilized for moving mechanical elements back and forth between predetermined positions in a calutron. Heretofore, during focusing of a calutron ion beam on the viewing face of a receiver, a suitable door mounted on the receiver is closed in order to avoid contaminating the pocket or pockets of the receiver. This was accomplished by mechanical linkages which required an air seal where they passed through the walls of the tank so as to enable remote operation from the exterior of the tank. By providing a mechanism disposed within a calutron tank and adapted to make an auxiliary electrodynamic or electromagnetic use of the magnetic field in the tank for opening and closing the aforesaid doors, the need for such exteriorly operated mechanical linkage is eliminated. (auth)

5063

CALUTRON CONTROL CIRCUIT. K. R. MacKenzie et al (to U. S. Atomic Energy Commission). U. S. Patent 2,733,350, January 31, 1956.

An electrical control was designed to prevent inadvertent overheating of water cooled structure of a calutron. The apparatus consists of interlocking devices connected to the electric current and voltage supplies of a calutron so that none of the electrical supplies can be operated unless cooling water is flowing to all of the structures that are to be water cooled. In one modification of the invention all of the water supplies of the calutron are interlocked with all of the electrical supplies by means of a single relay so that none of the electrical supplies can be operated unless cooling water is flowing to all of the structures that are to be water cooled. In another modification of the invention, the water supplies associated with the various water cooled parts of the calutron are individually interlocked with the electrical supplies which cause heating of the respective parts. (auth)

5064

MAGNETIC FIELD REGULATOR. K. G. MacLeish (to U. S. Atomic Energy Commission). U. S. Patent 2,735,044, February 14, 1956.

An improved electromagnetic field regulator is described which is capable of providing the accuracy of magnet field regulation necessary in the electromagnetic separation of isotopes. It provides an improved regulator capable of maintaining the flux between pole faces of a magnet constant within at least one part in 5000 for sudden changes and one part in 1000 for slow drift. It also provides the above stated accuracy without the attendant oscillations peculiar to any system striving for such sensitivity. It is generally comprised of means to compare the input signal to a reference voltage, a converter to change the result of the comparison to an alternating current signal, appropriate amplifiers, rectifiers and variable impedances, a dampening transformer having its primary winding connected in the magnet winding circuit and its secondary winding connected across the converter thereby providing an opposing regulator input signal for particular load fluctuations. (auth)

5065

AUTOMATIC VAPOR CONTROL. B. T. Wright, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,735,943, February 21, 1956.

A control apparatus has been developed to insure a stable arc in an ion generator by regulating the vapor flow thereto. It provides a simple electrical arrangement for automatically regulating a calutron vapor valve so as to maintain a steady flow of vapor from a vapor source to an ionization chamber whereby a more stable arc may be maintained within the ionization chamber. The flow of vapor to the ionization chamber is a function of the current flow to an acceleration electrode disposed adjacent the ionization chamber. (auth)

5066

SUPPRESSOR CIRCUIT. W. R. Baker et al (to U. S. Atomic Energy Commission). U. S. Patent 2,735,963, February 21, 1956.

Electronic switching apparatus was designed to cut off a power supply upon sudden voltage fluctuations in the load circuit of the power supply and further to maintain this "cutoff" condition for a period of time as set by the operator. The circuit is particularly adaptable to the control of calutron source voltage so as to eliminate sparking between two oppositely charged electrodes. (auth)

5067

REACTOR. E. P. Wigner et al (to U. S. Atomic Energy Commission). U. S. Patent 2,736,696, February 28, 1956.

A solid fueled, liquid moderated and liquid cooled slow neutron reactor is discussed. The solid fissionable material is natural U metal; the liquid moderator may be heavy; and the liquid coolant may be H_2O, biphenyl, or the like. The design provides for preventing losses of the fluid moderator due to leakage or contamination of the same by the liquid coolant. The reactor is characterized by good temperature stabilization at high neutron densities for extended periods of time, and provision for ready removal and replacement of the fissionable fuel when desired. The neutronic system includes an effective emergency control for reducing the reactivity, as well as automatic means for continuing proper cooling of the active fissionable material in the event of failure of the principal cooling system. (auth)

5068

LUBRICANT FOR COLD DRAWING OF THORIUM WIRE. C. D. Grahm et al (to U. S. Atomic Energy Commission). U. S. Patent 2,736,700, February 28, 1956.

A new lubricant has been compounded for cold working metals particularly for drawing or extruding soft metals as Th or Zr. The lubricant is a mixture of 2 to 5 parts by weight of MoS_2 and one part of finely divided leaded ZnO suspended in a drying vehicle which is a mixture of nitrocellulose lacquer and lacquer thinner. (auth)

5069

DISTRIBUTED PULSE HEIGHT DISCRIMINATOR. C. E. Wiegand W. Chamberlain (to U. S. Atomic Energy Commission). U. S. Patent 2,736,801, February 28, 1956.

A wide band pulse height discriminator which utilizes distributed circuit components is described. A plurality of series connected inductance coils are utilized having the midpoints of each inductance coil connected to the cathode of a diode tube, the anodes being connected together. These inductances in combination with the interelectrode capacitance of the diode tubes form an artificial transmission line which may also be referred to as a series of m-derived low-pass filters. Means for applying an adjustable voltage between the anodes and cathodes of said diodes is provided. (auth)

5070

PULSE HEIGHT ANALYZER SYSTEM. L. Cranberg (to U. S. Atomic Energy Commission). U. S. Patent 2,736,802, February 28, 1956.

A cathode ray tube has been used as a pulse height analyzer. Two horizontal rows of individually overlapping anodes are positioned across the face of the tube. The pulse to be analyzed is impressed upon the horizontal deflecting plates while the vertical deflection plates have a high frequency signal impressed upon them to sweep the beam vertically between the two rows of anodes. A trigger circuit is

provided to trigger the beam at the precise moment that the pulse to be analyzed is at its maximum. Appropriate amplifying and coincidence circuitry are connected to each of the anodes for measuring the voltage pulse when it is received on a particular anode. (auth)

5071

BLOCKING OSCILLATOR. J. C. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,736,806, February 28, 1956.

A circuit was developed for obtaining a short electrical pulse of higher power and of far greater steepness than is produced by the presently standard blocking oscillator circuit. Use is made of two interconnected vacuum tubes so interconnected that mutual amplification of pulses individual to the tubes is brought about, with the result that the circuit of each tube is a source of voltage pulses amplified by the other tube. In this way two independent circuits may be set in operation simultaneously. By introducing a delay line after one of the pulses, the two circuits may be operated successively. (auth)

5072

ION PRODUCING MECHANISM. W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,736,808, February 28, 1956.

An ion source has been modified to eliminate the undesirable influence of the accelerating electrode on the filament and the electron stream between the filament and the block. This is accomplished by placing a shield between the filament and the accelerating electrodes. (auth)

5073

ION GENERATOR AND PROJECTOR. C. G. Bacon (to U. S. Atomic Energy Commission). U. S. Patent 2,736,809, February 28, 1956.

An ion source is described wherein an arc is struck between two electrodes formed of uranium, one of them having an opening therethrough, through which the ions are projected in beam form. Other components of the source are: a collimating electrode, an accelerating electrode, a decelerating electrode and a pair of deflecting plates having an a-c potential impressed across them for sweeping the ion beam so that the plates constitute a vertical slit. (auth)

5074

CHARGE RECEPTACLES FOR USE IN ION SOURCE UNITS. A. F. Clark (to U. S. Atomic Energy Commission). U. S. Patent 2,736,810, February 28, 1956.

A calutron ion source is provided with an improved arrangement controllable from the exterior of the tank for opening a sealed charge receptacle into communication with the charge ionization chamber of the source. (auth)

5075

CALUTRON RECEIVER. H. F. Weaver and C. M. Van Atta (to U. S. Atomic Energy Commission). U. S. Patent 2,736,811, February 28, 1956.

A calutron receiver is described having a beam viewing face defining one or more beam receiving areas, such as slots or electrode surfaces, properly shaped or oriented to fit the focal patterns of the beam components respectively to be received thereby with as high a degree of accuracy as possible, and without employing elements having dished or warped surfaces. The beam viewing faces are constructed in a manner particularly suited for duplication in large numbers and yet adapted to fit the warped or non-planar focal patterns of the beams with a high degree of accuracy. (auth)

5076

RADIOACTIVITY MEASURING APPARATUS. A. I. Weinstein and F. T. Bonner (to U. S. Atomic Energy Commission). U. S. Patent 2,736,812, February 28, 1956.

Improvements were made in radiation-measuring devices for measuring the low level β emissions from gases under low pressure. A radiation sensitive cell e.g. a Geiger-Mueller tube is separated by a thin mica window from a rotatable chamber connected in series in a gas conduit. To allow for the free passage of gas through the chamber a tube connects with the gas line inlet and outlet. To introduce the subject gas into the chamber, the assembly is rotated 90° allowing the gas to enter and exit from ports in the chamber, the gas then being measured by the counter. This arrangement allows the isolation of gas from the window under extreme pressures; the testing of gas while in transit over lower pressures and accomplishes this without removing the gas from the system. (auth)

5077

POCKET RADIATION METER. P. R. Bell, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,736,817, February 28, 1956.

A portable light weight radiation meter which is provided with a calibrated logarithmic indicator scale for covering ranges of intensities, permitting of direct reading on a single scale of the harmless to the disastrous ranges of radiation is described. The meter contains a battery operated vacuum tube and associated novel circuitry. (auth)

5078

MEASURING DEVICE AND APPARATUS. F. R. Shonka (to U. S. Atomic Energy Commission). U. S. Patent 2,736,818, February 28, 1956.

A portable measuring apparatus was constructed as to permit of two different levels of radiation to be read on the same scale, thus permitting direct reading of said two ranges. The device is so constituted that by gravity one resistor falls in series electrically with the ionization chamber and associated meter scale and by inversion of the device, the other resistor is connected with the ionization chamber and its associated meter scale to permit of reading on said inversed scale. (auth)

5079

ION SOURCE FOR A CALUTRON. W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,737,589, March 6, 1956.

A calutron ion source having an improved electrode arrangement productive of a uniform and copious supply of ions consists of the following features: an improved mount for the ion source which increases the efficiency of the vacuum seal; independent heating elements for the vaporization chamber and the ionization chamber; a water cooled cathode capable of adjustment while the source is in operation; accelerating electrodes mounted as unitary elements but separately adjustable; and a novel structure for tensioning the source mount against the calutron tank. (auth)

5080

ION SOURCE FOR A CALUTRON. E. J. Lofgren (to U. S. Atomic Energy Commission). U. S. Patent 2,737,590, March 6, 1956.

The mount for a calutron ion source has been improved. It provides mechanism for adjusting the relative positions of the exit slit from the arc chamber and the passage between the accelerating electrodes through several different planes with respect to the other elements of the calutron. An important feature of the invention resides in the combination of gimbal rings in which an ion source support stem is suspended, with mechanism constructed to provide both axial translation and rotation of the support stem. (auth)